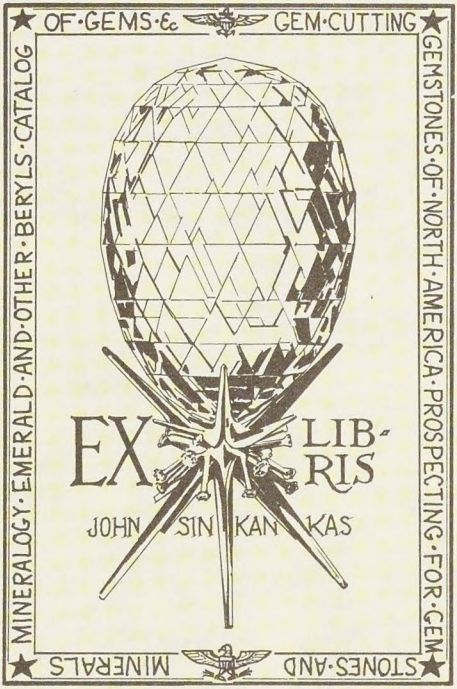
CRYSTALS AND GOLD

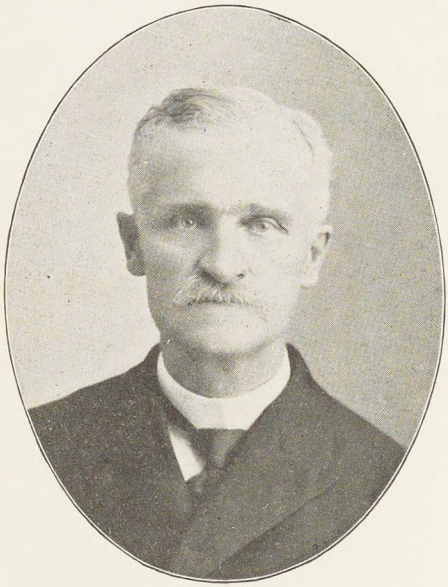
R. T. CROSS



To Walter and Howard
for faithful attendance
at church

R. T. Cross,

June 1909



CRYSTALS AND GOLD

BY
R. T. CROSS
Author of *Home Duties*,
Clear as Crystal, *etc.*

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To the memory of my elder brother,

JUDSON NEWELL CROSS,

My companion in boyhood, my friend in manhood, my sympathizer and helper in all scientific and literary enterprises, a brother in whom was no guile.

PREFACE

WHAT THIS BOOK IS NOT;—It is not a scientific treatise on crystals. The author is not a scientist in the strict sense of the word, but only an amateur. He has never analyzed minerals, nor has he measured angles or used the blow-pipe to any great extent.

Neither is it a guide to American mineral localities. The author has been permitted to visit a goodly number of localities, but the number has been small compared with the many that he has not visited.

WHAT THIS BOOK IS;—It is a simple record of the thoughts and experiences of a mineral collector, and as such the author thinks that it may be of interest to other amateur mineralogists. It is a record of fact and of actual experiences, except the chapter that is frankly called a crystal yarn—and even in that chapter some readers will find considerable truth.

It is a nature book, one of those books, of which so many have appeared in recent years, that are both cause and effect of the increased study of nature by the people. It is the author's humble contribution to the popular study of God's world, drawn from a realm not so familiar to the people at large as the realms of flowers, birds and stars.

The first three chapters are the substance of a lecture on CRYSTALS, and the last one is a lecture on GOLD, both of which have been given in many places, and at a num-

ber of academies and colleges. Chapters 7, 8, 9, 14 and 16, and parts of some of the other chapters, have appeared in different periodicals in nearly the same form as here given. Chapter 13 is condensed from the author's book of children's sermons, CLEAR AS CRYSTAL. The author's love of nature is a part of his religion. He has not tried to leave God out of this book and he has no apology to offer for the insertion of a chapter on moral and religious lessons drawn from crystals and crystal hunting. It is hoped that the book will be found worthy of a place in public, school, and Sunday school libraries.

R. T. C.

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CHAPTER I.

Crystals and How They Grow.

A long time ago—four thousand years, more or less —some men, or women, or possibly some boys, or girls, were wandering among the rocks somewhere in the eastern hemisphere when they found some clear and colorless crystals of quartz.

"What is it?," said one of them.

"It is ice," said another.

In their language the word for ice was 'krustallos.' "It is krustallos," said he.

"But it does not melt in my hand," said the first.

"Well," said the other, "it must be krustallos frozen unusually hard like stone."

And so they called it ice, or krustal, from which comes the word crystal. For many centuries the scientific theory about it was that it was ice frozen unusually hard. There was a measure of truth in the theory, for if crystals are not ice, ice is sometimes found in crystal forms. Ice is one mineral, water, which freezes, or becomes solid, and also melts, at an unusually low temperature.

The word crystal was doubtless first used of clear quartz crystals, and one will find intelligent persons now in every part of the country who use the word as though it applied only to quartz, or as though it meant only one kind of mineral. It is difficult to make them understand that it is a general word used for the regular form of any mineral. In the common use of the word, in many names commonly given to minerals, and in many common theories about minerals, there is a vast deal of ignorance, even among intelligent people. A few simple lessons, or talks, in our schools, on rocks and minerals would do much to dispel such ignorance.

Definition. A crystal is defined as "the regular form which a substance tends to assume in solidifying, through the inherent power of cohesive attraction. It is bounded by plain surfaces symmetrically arranged around certain imaginary lines called axes." This definition rules out irregularly shaped stones, those shaped by men, those without regular angles, as also all forms of animal and plant life.

Minerals crystallize, but not what are commonly called rocks: though rocks may have a crystalline structure. Granite is a rock composed of three minerals, mica, quartz and feldspar, mechanically combined; while each of those three minerals is composed of certain simple elements chemically combined. We find crystals of mica, of quartz, and of feldspar, sometimes in the same piece of rock, but no one ever found a crystal of granite, although a distinguished semi-scientific writer speaks of such a thing in one of his books. The granite may contain crystals of those minerals and thus be crystalline in structure, but it is not crystallized.

Formation. How are crystals formed? What is the process of crystallization and how is it explained?

We tread on mysterious ground when we ask these questions. To rightly answer them we must enter the holy of holies in nature's wonderful laboratory, and see in operation the primal laws of matter. We can see that crystals grow: possibly in some cases, as in frost crystals, we may see them grow, but we cannot see the molecules arrange themselves. We see results, not processes. It is, as Tyndall has shown, one of the instances in science where we are obliged to use the faculty of imagination.

The ultimate particles of matter are called atoms. The atoms of two or more simple elements (of which upwards of seventy have been discovered) combine with each other in certain definite proportions. The result is called a molecule, a molecule being the smallest portion of any substance which possesses all the properties of that substance. There is probably a certain definite form for the molecule of each mineral. According to some scientists these molecules have positive or negative poles which attract or repel each other. When these molecules are near each other and are free to move they approach one another and are locked firmly together, one after another being added, and thus a crystal being formed.

Conditions of Crystallization. There are three conditions in which a mineral may exist that are favorable to the formation of crystals. It may be in a melted state, like sulphur or water which, under favorable conditions, crystallize as they cool. Or it may be dissolved in some liquid, as alum and sugar are dissolved in water, and form into crystals as the liquid evaporates. Or it may be in the form of vapor and crystallize as it condenses, as the vapor of water forms snow crystals when it condenses. Heat separates or unlocks the molecules, while in the absence of heat they come together again.

Experiments indicate that some massive minerals may become crystalline internally without being melted or dissolved, as for example iron rails under the repeated pressure or blows from car wheels. Crystals may possibly be formed in rocks deep down in the earth that are in a rigid condition from great pressure, but that are so hot that they are molten, or would be if the pressure were removed. Or the crystals may be formed in the gradual cooling of such rocks. Metamorphic rocks, or those that have been changed by heat, are generally crystalline in structure.

The Crystallizing Power. This marvelous power which draws and locks together the particles of matter to build a crystal—who can explain it? Call it molecular attraction, call it electricity, call it by what name you please, it is still a strange, mysterious power. It is the life power of the inorganic world. No form of matter that possesses it can be called 'dead matter.' There is power there, and all power comes directly or indirectly from will. A theory has been broached that there is real life in the atoms of matter. If that theory should be proved it would help explain many difficult things, but it would overthrow many other theories. It would not solve the mystery of life but would make it far more complex than it is now. One scientist says: "The beginnings of the crystal are no less unknown and undiscoverable than the beginnings of the cell. The ultimate causes which lock the atoms of the one in an angular embrace and quicken with pulsating life the corpuscles of the other, lie beyond our ken."

I, for one, can derive no satisfaction from the contemplation of this wonderful force in the atoms and molecules of matter except as my thoughts, carried back on the currents of that force, find at last a resting place in

that primal force, that power, that uncaused cause, that Person, that we call God, whom we revere not only as the Creator, but also as the Upholder of all things, whose will power energizes all nature, who is not only over all things, but in and through all things, immanent as well as transcendent.

An Illustration. That we may better understand how wonderful is the process of crystallization let me give in my own words an illustration used by Ruskin in his Ethics of the Dust. Suppose you wish to build a magnificent cathedral, with its solid walls, its arches, its graceful minarets and towers and lofty spires. The material for it, stone, wood, brick, glass and iron, is lying on the ground in inextricable confusion. A fairy appears on the scene with magic wand, and at her command every stone and brick, every piece of wood, glass and iron, without haste or waste or confusion, flies to its place, puts itself in the right direction, at just the right angle, and lo! the cathedral is built. And thus it is that a crystal is built. and the fairy-like power which brings them from hither and thither, and locks tightly together the myriad molecules—we call it a law, and are satisfied with that cold name that explains nothing. We would better call it God, God creating a crystal, as he once created this world, out of chaos.

Going on Now. And this process of crystallization is not something that was finished once for all when the earth was made, or when, ages ago, the rocks assumed their present condition. It is still going on, and it is a part of the process by which the world is still being made. In dark caves, in moist crevaces, in little cavities in the rock, in decaying rocks whose elements are being set free and entering into new alliances, within petrified shells and round geodes, in beds of clay, in fiery volcanic

depths and within old volcanic rocks, the tiny molecules, that no eye can see or microscope discover, drawn by the wonderful power of which I have spoken, come together quickly, sometimes many, sometimes few, and in the course of days or years or centuries build a crystal, even as the tiny animal slowly builds a coral reef. In total darkness the atoms of a given element recognize the atoms of other elements for which they have an affinity, and they enter into precise mathematical relations with them, just so many of each kind and no more. They form a molecule whose physical appearance is unlike any of the original elements. By some subtle law of affinity those molecules know each other, and in countless places at this moment they are drawing together and being locked together; they are building a crystal which ages hence will be found and admired by some lover of crystals, or which perchance shall shine in some kingly crown or flash the light from some beauty's brow.

Artificial Crystals. Moreover it is in the power of man to furnish or arrange the conditions for making crystals of many of the minerals. Such crystals are called artificial, but they are natural in the sense that they are made strictly according to nature's laws. They are real crystals, not imitations, like imitations of precious stones. Dissolve alum, sugar, or salt in water; let the water evaporate slowly, and you get artificial crystals of those substances. Melt sulphur and then let it cool. After a crust has formed on the surface draw off what is under the crust and the lower part of the crust will soon be covered with crystals. I have some fine clusters of selenite (crystallized gypsum) that were formed in the salt works at Syracuse, N. Y. I have found selenite crystals slowly forming on a piece of iron that had been

left in a gulch whose clayey beds were saturated with gypsum.

Some old Roman coins made of lead and copper were found in Algeria. In little cavities between the coins were found small crystals of cerussite, which is a carbonate of lead, and malachite and azurite, which are ores of copper. In the slag of smelters one will often find crystallizations that have taken place when the slag was cooling. All are familiar with the artificially formed crystals of alum and blue vitriol seen in drug stores, and with crystallized rock candy. I have a crystal of maple sugar that formed in one of my mother's cans of maple syrup over forty years ago. When I went to college I took it to the professor of mineralogy to see if it would puzzle him. It did for a few moments only, until he touched it with his tongue.

The formation of artificial crystals would make an interesting specialty for some young scientist. He might stumble on a fortune. He would if he could learn the secret, and then keep it, of turning a ton of coal, say eight dollars' worth, into eight billion dollars' worth of diamonds, for coal and diamonds, as all know, are chemically the same substance. That is why coal is called black diamonds. He could also make a fortune by learning to make sapphires and rubies out of clay, which is practically the material out of which nature makes them. Experiments have been made along these lines, and with some success. But the crystals produced thus far are very small. The secret however will certainly be wrested from nature; it must be, for there are no limits to man's discovery of nature's secrets. When these secrets are discovered diamonds, sapphires and rubies will be 'dirt cheap.' The poorest can own them then, and they will be just as beautiful as they are now.

THINGS OF BEAUTY. A crystal is a thing of beauty, and hence a joy forever, that is, if it is a beautiful crystal, on the same principle that "hash is good if it is good hash." I must admit that some crystals are very homely, being badly distorted and sadly mixed with impurities. And such crystals are sometimes found side by side in the same nest or pocket with the clearest and most beautiful ones.

Ah! how many beautiful crystals and rare gems have been bruised and broken and ground to powder amid the crash of moving rocks and grinding stones! They have 'blushed unseen and wasted their sweetness on the desert air'; they have helped to make the sands of the desert and the sticky mud of our streets. If men learn the secret of turning sand and clay back into crystal gems it will be no more than poetic justice.

And oh! how many wonderful crystals and groups of crystals are hid away in the earth! It makes one almost wild to think of them.

"Full many a gem of purest ray serene
The dark unfathomed caves of ocean bear."

Caves of earth the poet might more truthfully have said. They are tinged with richest colors, but there is no light to reveal, nor eye to enjoy, their colors. They have forms that are mathematically faultless, but no mathematician measures or appreciates them. Some of them are fit to be set in kingly crowns or shine on the breasts of fair women, but the hard rock or the moist clay closes them round and will not let them go, not until their time comes.

New localities for crystals are constantly being opened, and some crystals that were once quite scarce are

now abundant, and much cheaper of course. It would be unfair for one generation, much more for one person, to find all the nice crystals and gems. Some must be kept in reserve for future generations. If it is allowed to departed spirits to visit the earth at will I think my spirit will sometimes be found hovering around the places where rare gems and fine clusters of crystals are being dug out of the earth.

John's Use of Crystals. The word crystal is found five times in our English Bible, and it is used three times in the book of Revelation in describing the purity and beauty of the New Jerusalem. In his wonderful vision John saw before the throne a sea of glass like unto crystal. And he says that the light of the New Jerusalem is like unto a stone most precious, clear as crystal. And he was showed a pure river of water of life, clear as crystal, proceeding out of the throne of God and of the Lamb. John would not have thus used the clear crystal in describing that marvelous city if he had not admired crystals. Perhaps he had a little collection of them, and when he saw one it would remind him of the sea of glass, the river of life, and the wondrous light of the New Jerusalem. "Whatsoever things are lovely * * * think on those things." The clear and the clear cut crystals are lovely, and as I look at their smooth surfaces or gaze into their crystalline depths, my thoughts, even as the process of crystallization carried them back to God, are carried forward to that spiritually crystalline city whose walls are made of crystals, whose gates are of pearl, whose streets have no dust but gold dust, whose crystalline light falls on crystal sea and crystal river, and where souls that are clear as crystal are jewels forever in the crown of Him who redeemed us.

CHAPTER II

About Crystal Forms

When one looks into large books on mineralogy and sees hundreds of curious geometric figures, labelled with all sorts of letters and fractions, with page after page of intricate and long drawn out equations and formulas, sines and co-sines; arithmetic, algebra, geometry, plane and spherical trigonometry all rolled into one, he is apt to feel that he has stumbled upon a hard, dry subject.

It does not relieve one's apprehensions to spell out such words as holohedral, trigonal-trisoctahedron, tetrahexahedron, tetartohedrism, holohemihedral, anisometric, clinodiagonal, brachypinacoid, hemi-trisoctahedron, hemitetrahexahedron, etc.

There is however much that is fascinating and beautiful about crystals of which one can get the benefit without going through the intricate mathematics of the subject, and yet if one has the time and patience to delve deep into the science of crystallograpy he finds a rich reward for his labor. He finds certain laws of symmetry and of beauty that give him a new view of the wisdom

displayed in creation, and a new proof of the existence of the supreme intelligence to whom that wisdom belongs.

Axes of Crystals. The axis of the earth is an imaginary line running through its center from pole to pole. The axes of crystals are imaginary lines also, running through their center from top to bottom, from side to side, and from back to front. These axial lines are of different relative lengths and are differently inclined to each other. On these different relative lengths and different inclinations are based the six great systems of crystallization, under which all crystals are classed. The first and most important is

1. The Isometric System.—Isometric means equal measure. In this system the three axes in any one crystal are of equal length and are at right angles to each other. The simplest form is the cube. Clip the corners of the cube symmetrically until the clippings meet in points, and you have the cubo-octahedron. Continue the clippings until they meet in lines instead of points, and until the original faces of the cubes have dwindled to a point, and you have the octahedron, which is represented by two four sided pyramids placed base to base. Clip the edges of the cube in the same way and you get the dodecahedron, a twelve sided figure, which is frequently the form taken by garnets and iron pyrites. And so by various changes a great variety of forms arise under this system. It is nature's simplest system of crystallization, and she uses it for some of her most precious, and for some of her most common and most useful substances, as gold, silver, iron, lead, copper, the diamond, fluorite, salt, garnets, and many other minerals.

2. In the Second or Tetragonal System, the two lateral axes—those from side to side and back to front—are equal, but the vertical axis is either longer or

shorter than the others, while all are at right angles to each other. Two or more cubes placed end to end, or a cube cut in two, would illustrate this system. So would a four sided stick of timber that was square at the ends.

3. The Third or Hexagonal System is the same as the preceding except that there are three lateral axes instead of two; thus making a six-sided prism, as in the case of quartz, beryl, sapphire, etc.

4. In the Orthorhombic System the three axes of the crystal are unequal in length but are at right angles to each other. The form of a common book illustrates it. Sulphur and topaz crystallize in this system.

5. In the Monoclinic System the lateral axes are at right angles to each other, while one of them is at right angles and the other is oblique to the vertical axis, all being of unequal lengths. Such a crystal will lean one way, as a book or a piece of timber would if a wedge-shaped piece were cut from one end. Gypsum, mica, hornblende and some feldspars crystallize according to this system.

6. In the Triclinic System the axes are of unequal length and are oblique or inclined to each other. Some of the feldspars crystallize in this way, and a number of rare minerals.

From these six simple systems an almost endless variety of forms is derived. Calcite, or Iceland spar, is rhombohedral under the hexagonal system, but some two hundred or two hundred and fifty (some writers say six hundred) variations in its form have been noticed. The crystal of water is hexagonal, but not less than one thousand forms of snow crystals have been noticed. All of them are beautiful, many of them exceedingly so.

Quartz Forms. Besides the great variety of form under the same system there is endless variety under the

same form. Take as an example the simple form of quartz, a six-sided prism, terminated at each end with a six-sided pyramid. Here in my collection is one crystal that is regular, symmetrical and just about perfect. But such crystals are rare. I have many that grew out from the side of a cavity and hence have a termination at but one end. One crystal is long and slender like a tooth-pick. Another has three alternate sides of the prism so narrow and the other three so wide that it looks like a common file, or like a three-sided prism. One tapers gradually to a point, the resultant of two forces in the construction of the crystal, one of which kept trying to finish the crystal by putting on the pyramid, while the other kept trying to make the crystal a little longer. Sometimes the crystal tapers in a series of short steps, showing that the two forces worked alternately, one resting while the other worked. Each tried to steal a march on the other. One crystal is very short and chunked, while another is finer than a cambric needle.

The prism of one crystal is so narrow that it appears as only a little line between the two pyramids. Sometimes it is crowded off entirely by the selfish pyramids, so that the crystal is all pyramid and no prism. In many of my crystals the faces of the pyramid are crowded down to minute points by the enormous enlargement of the other faces, yet they never, perhaps I should say hardly ever, suffer themselves to be crowded off entirely. Look close, with your microscope if necessary, and you will see a little point of light that stands for the plane that is apparently missing. One specimen starts at one end as one crystal, but terminates at the other end in a number of crystals. Some crystals have each face, or plane, broken up into a great many little faces, or planes—and so on in endless variety.

Locality Variations.—The crystals from one locality, being formed under the conditions peculiar to that locality, are apt to have certain peculiarities which an experienced eye can quickly detect, just as one can detect the nationality of persons whom he meets if he has been an observer of faces and races. If I should go to China and see there a crystal of tourmaline from Pierrepont, N. Y., or a quartz crystal from Herkimer county N. Y., I should know it at once, and know where it came from, even though it were labelled as coming from Siberia. I have dug and handled too many crystals from those localities not to recognize them at sight. I would as soon think of not knowing my own child because he was labelled as being the child of another.

When I come across crystals from certain localities I recognize them as old friends, as I do when I meet people from my native town. I can talk with them familiarly about the region from which they came. "Ah! my pretty black tourmaline, how did you get so far from home? Are you ever homesick for that stony pasture lot from which you came, with the forest on one side and the old mill in the valley on the other?" And yet it is true that among the thousands of separate crystals that I have found in some localities I have never found two exactly alike, though of course the corresponding angles are the same. Such infinite variety in unity do we find in the crystalline world, even more, it seems to me, than in the animal and the vegetable worlds. It is one of God's laws.

Connecting Links.—The forces that construct the crytal seem to keep its original plan always in sight, but they constantly deviate from it more or less and build upon it all sorts of regular and irregular variations. There are far more "connecting links" between mineral substances and crystal forms than there are between ani-

mals and plants. Minerals are sometimes caught in the very act of developing from one species into another. I have crystals of one mineral that are partly changed into another mineral. I have "cubes" of iron pyrites that have been flattened into book form, and cubical crystals of gold that are in the shape, some of them of wires and others of leaves. They are cubes in theory and something else in practice. They are like Ethiopian albinos, or white blackbirds.

Odd Forms. Some crystals, as the diamond and pearl spar, have curved faces. Their planes are not plain. Some crystals are themselves bent, or geniculated. Some take the form of rosettes. Iron pyrites is found in cubes, but by twining and twinning a good many cubes together, nature makes round balls out of them, which is a little different from squaring the circle; she spheres the cube. She makes cylinders and hollow stalactites out of the same material. Sometimes—strange to say and hard to explain—a mineral is found crystallized in different systems, in two, three, or even more. This is called dimorphism, or polymorphism. Nature cuts up many capers in the crystal realm, playing fast and loose with her unchangeable(?) laws. She produces many "sports" and "freaks." Environment has much influence, but upon the whole she is fairly loyal to the mathematical laws upon which crystals are built.

Crystal Neighbors. Crystals of different minerals are often found in close and loving proximity, four or five or more varieties in the same cavity. Some of nature's laboratories have a great variety of substances, and thirty or forty or more mineral varieties have been found within a small area in certain localities.

Twins. Only crystals of the same mineral are found in twins. Twins are very common with some minerals,

as selenite and feldspar. Mineralogy applies the term, not, as we would, to crystals attached to each other in Siamese twin fashion, but to those in which "one or more parts regularly arranged are in reverse position with reference to the other parts." In some of them it is as though the crystal had been cut through the middle and one of the halves turned half way round. It was not actually turned but it grew in that way.

Penetration twins are those in which two or more complete crystals interpenetrate, crossing through each other as it were. In this way staurolite forms perfect Maltese crosses, and Xs, and starlike clusters. Contact twins are those in which two or more complete crystals are placed side by side in reverse order. When gypsum crystallizes in this way it produces "arrow heads" of selenite. Snow crystals are variously twinned, the crystals generally radiating from a center and forming a star or wheel.

Pseudomorphs.—These are among the curiosities of crystals that verge on the comic. They are false forms, as the name indicates. A mineral is found in a form that does not belong to it, but that does belong to some other mineral whose form it has stolen, as one bird sometimes steals another's nest. It occurs in various ways. The original crystal or material may be gradually removed and another substance gradually take its place. In this way wood is petrified, not into crystals however, though crystals often form in the cavities. The wood does not, strictly speaking, turn into stone, but it disappears and the stone is substituted in its place. Sometimes one mineral is deposited over another and thus naturally takes its shape.

Again a cavity formed by the removal of one mineral is filled with another mineral. Of course the new-

comer, if it fills the cavity, has to assume the shape of the old occupant. Most pseudomorphs, however, are formed by chemical alteration. Sometimes it is by losing one ingredient, as when siderite loses its carbonic acid and becomes limonite. Sometimes it is by taking up one ingredient, as when cuprite takes in carbonic acid and thus becomes malachite. Sometimes it is by dropping one ingredient and taking up another, of which there are many examples. Sometimes the change is not complete when the crystal is found, and a core or kernel of the original mineral is found in the center, or one side of the original crystal may be unchanged.

No doubt we have often thought how it would seem to be somebody else. The crystals often try that experiment. Perhaps they think they will pass unchallenged in the dark where the changes take place, but the light reveals every one of what manner of crystal it is. How ashamed some of them must be to be caught thus masquerading when the light breaks in on them! And what a disgrace it must be for some of them to be put in our collections where again and again their hypocrisy will be pointed out. Here in my collection is a piece of quartz that is masquerading under the form of a crystal of calcite, but it is quartz pure and simple in spite of its stolen mask. Here is another piece of quartz that has the form of a baryta crystal that flourished, grew old and died long ago. The little quartz crystals, however, that have grown out from the surface, knew no better than to betray their mother by taking the regular quartz form. They revert to the original type. Here is some chlorite that has the shape of a garnet. And so many crystals, not all, sail under false colors and try to deceive us. Sometimes the result is a happy one and gives us practically a new gem. This beautiful tiger-eye stone from far-

away Africa, with its changing lines and belts of color as you move it, is simply quartz; it is quartz after crocidolite. The stone was originally crocidolite, a fibrous variety of hornblende, that does not take a polish, but by some chemical change it became quartz, which takes a fine polish, and now how beautiful it is! The beauty comes from both the crocidolite and the quartz.

What I have written about the forms of crystals may seem to some of my readers dry and technical, but it is only an amateur's essay, for far beyond and above all that I have said lie vast fields in the science of crystallography, which is only one branch of crystallology. The writer knows just enough about crystals to stand on the edge of those vast fields and look longingly into them and exclaim: "Alas, I am only an amateur, and know nothing at all!" But O, friends, I have seen some forms of wondrous beauty and shapes of rare interest. I am learning a part of nature's complex Chinese alphabet and spelling out a few of God's thoughts. There are rich treasures on beyond. Come and enjoy them with me.

CHAPTER III.

More About Crystals.

Size. Crystals are of all sizes, from those extremely large to those extremely small. I looked once through a microscope that had a power of one thousand diameters, or one million surfaces, and saw crystals so minute that twenty-five thousand of them placed end to end would make a length of only one inch. They were embedded in pieces of rock that had been sliced and polished to a thinness of one two-hundredths of an inch.

When the sun is shining upon certain rocks we see myriads of shining points. Each brilliant point is one of the faces of a minute crystal, generally a quartz crystal. A friend shook out of a piece of petrified palm wood what seemed to be a very fine dust. When we put it under the microscope each particle of the dust proved to be a quartz crystal with eighteen sides. I shook out of a geode from the Bad Lands some shining dust, each particle of which was also a quartz crystal. Iron pyrite crystals have been found so small that it would take eight million for a cubic inch.

In a small homeopathic bottle I have seventy-five quartz crystals, and in another bottle not much larger I have two hundred. In Crim's exhibit of Herkimer

county crystals at the world's fair in 1893 there were a thousand crystals whose total weight was only three and three fourths grains. It would take one hundred and twenty eight thousand such crystals to weigh an ounce, and more than two million to weigh a pound. Others from that locality have been selected of which it would take one million two hundred and twelve thousand for an ounce. In a pound of such crystals there would be nearly twenty million. The person who vouches for this latter fact says that the crystals are there, if one had the patience to pick them out, of such diminutive size that ten million of them would weigh only an ounce, or one hundred and sixty million to a pound. We need not go farther in that direction.

Per contra, near Pike's Peak single crystals have been found weighing nearly forty pounds, and one that was nearly six feet long. A group of crystals in Naples weighs nearly one thousand pounds. A single crystal in Milan weighs eight hundred and seventy pounds. It is five feet six inches long and three feet nine inches broad. From one cavity in the Alps, discovered in 1867, there were taken twenty thousand pounds of smoky quartz. There were a thousand big crystals, many single crystals weighing from two hundred to two hundred and fifty pounds. It is said that thirty tons of quartz crystals were taken from one cavity in Arkansas.

A great mound, or huge geode, of selenite was found in Utah. In the interior were huge beams of selenite crystals, some of them five feet long and weighing a hundred pounds. Transparent cleavages were secured that were six feet long and two and a half feet broad.

A crystal of beryl was found in New Hampshire four feet long and two and a half feet in circumference. Another one that weighed twenty-nine hundred pounds

was four feet three inches long, thirty-two inches in one diameter and twenty-two in the other. The largest beryl found there crumbled, or was broken, in getting it out. Its diameters were twenty-four and forty-five inches and it was estimated that it would weigh two and a half tons, or five thousand pounds. It would be eight hundred thousand million times as heavy as those smallest Herkimer county crystals. Who could estimate its value if it were a transparent green beryl, in other words an emerald?

The largest quartz crystal ever found was discovered in a mine in California in 1897. It was four feet two inches in length and three feet six inches and three feet two inches in its two diameters. Its circumference was eleven feet and seven inches. It weighed twenty-two hundred pounds, a good "long ton." It was so clear that objects could be seen distinctly through it. It was estimated that a faultless ball twelve to fourteen inches in diameter could be cut from its center.

Crystal balls, by the way, are quite the thing to have and are very valuable when of considerable size. The material for big balls is quite scarce. A crystal sphere in the Dresden Green Vaults is 6.69 inches in diameter. One in this country that came from Japan is 6.625 inches in diameter. It is valued at five thousand dollars. It is said that Miss Helen Gould owns one that is nearly eight inches in diameter. It was the life work of three educated Japanese. It is worth eight thousand dollars, while its gold and crystal mounting cost seven thousand dollars more.

Large crystals are not generally very perfect, although I once had in my collection a garnet from Salida, Colo-

rado, weighing fourteen pounds, that was a remarkably clear cut and regular dodecahedron. Crystals that combine bigness and beauty bring big prices.

Color. The color of crystals is a very interesting subject. It is a very practical subject also, for the differences of color in the diamond and other precious stones may mean a difference of thousands of dollars in their value. We find in crystals every color and every shade of color, just as we do in flowers. One would naturally suppose that sunlight has much to do with the wonderful colors of flowers, blooming as they do on the surface of the earth and taking a sun bath almost every day, and so doubtless it has. But how do the crystals get such brilliant colors, formed as they are in solid rocks and soil, and in dark cavities where no ray of light ever enters?

While the crystal is being built up in the dark there is woven deftly through it a slight admixture of some coloring substance, a little iron perhaps, or manganese, or some subtle substance that the chemist can scarcely detect. When the crystal at last sees the light, or is seen by means of it, it has a smoky color, or is jet black, or grass green, or snow white, or cerulean blue, or ruby red, or rose red, or bright yellow, or cinnamon brown, or light pink, or dark purple, or one of the thousand other colors and tints found in crystals.

They were made in the dark, away from the sunlight, and yet we know not what subtle chemical influences the sun, through the ages in which it has been shining on the earth, has woven into all the surface rocks of the globe as particle after particle of those rocks has come under its influence. It is a suggestive fact that brilliant gems and brightly colored crystals and shells are not generally found at great depths in earth or ocean.

Crystals of tourmaline have been found that were bright red at one end, blue in the center, and bright green at the other end. Or the red would pass into white and the white be tipped with green. They make beautiful gems when clear, and they bring high prices as cabinet specimens. Some tourmalines exhibit the strange play of colors called dichroism, or polychroism, showing two or more colors as they are viewed in one or another direction.

In labradorite and opal we get a beautiful play of colors, the cause of which is something of a mystery. Many regard it as caused by internal fractures. Some crystals of diaspore are azure blue when seen along the line of one axis, wine yellow when viewed in another direction, and violet blue when held in still another position. Some crystals show a paler color, and some a deeper color, by lamp or gas light than by sunlight. The electric light is more like sunlight in its effect on color. If one wishes his crystals to show off well he must give them plenty of light. Some of them do not reveal half their beauty unless the sun is shining directly upon them. One might about as well look at crystals in the dark, or with closed eyes, as to try to see their beauties in some of the dark rooms or corners where they are sometimes placed. A mineral case should be placed where the light from a window falls directly upon it. If your drawers of crystals are not already in a good light take them into it when you exhibit them, if you would have them appreciated.

Posphorescence. Under certain circumstances some minerals phosphoresce, or emit light in the dark. Fluorite when heated to a temperature of 300 degrees Fahrenheit, shines with beautiful colors. The experiment is easily tried by putting small fragments of it on a hot shovel in a dark room. It is said that protoxyd

of iron colors many of the gems, yet some of them exhibit strange phenomena when heated. Some lose their color entirely, some change to another color, and some regain their original color when they become cool. The entire loss of color under the blowpipe was the distinguishing mark by which I was enabled to determine the name—zircon—of some beautiful crystals that were found near Pike's Peak.

Transparency. This is closely related to the subject of color. Many crystals are entirely opaque. Others let the light through their edges, or through their sections. Others are translucent, letting light through but not enough for distinct images. Others are as transparent as the most transparent glass. Some are transparent in spots, like some people, or transparent at one end and opaque at the other. The same mineral may be opaque, translucent, or transparent. Even one of its crystals may be all these in its different parts. Here is a quartz crystal from Herkimer County, N. Y., and another from Arkansas. Both are as transparent as glass, but the New York crystal has a sparkle and brilliancy that far excels the uncut, and rivals the cut, diamond. The Arkansas crystal seems dull by its side. Some crystals of epidote and tourmaline are transparent when looked at in one direction, but opaque when viewed in another direction. Now you see it and now you don't see it, as you look at an object through such a crystal as it revolves.

Double Refraction. All crystals, except those that belong to the first, or cubical system of crystallization, possess the peculiar property of double refraction. Calcite, or Iceland spar, possesses it in a remarkable degree. Hold a clear piece of it over a pencil or ink line and you see two lines. The distance between them depends on the thickness of the piece of spar. Turn the crystal half way

round and the two lines appear as one. They exactly overlap in width but not quite so in length. The composite line will be as much longer than either of the lines taken separately as was the greatest distance between the lines when they were separate, as is evident if the lines are of different colors. If it is a point or dot that you look at instead of a line you see two of them, which revolve around each other as the cystal is turned.

Electricity. Some crystals, as those of topaz and of tourmaline, are electric when heated, as when they are rubbed briskly for a time on cloth. On account of this strange property some of the tourmalines first brought to Europe from Ceylon were called by the Dutch aschentreckers or "ash-drawers". These strange stones aroused great interest and for a time were much sought after by fashionable people and by scientists. Such crystals when heated will either attract or repel bits of paper, thread or ashes. All minerals are more or less electric by friction. The diamond is positively electric whether polished or unpolished; the other gems only when polished. The topaz will continue its electric excitement for several hours.

Cleavage. If I pound one of my quartz crystals to pieces with a hammer the fragments will be of irregular shape like broken glass. They will bear no resemblance to a quartz crystal. In other words quartz has no cleavage to speak of, though it does show a little in one direction when a hot crystal is plunged into cold water. If I break one of my topaz crystals with a hammer it will break into pieces that are flat and smooth across the length of the crystal. Thus the topaz shows cleavage in one direction, parallel to the terminal plane.

If I break a fluorite crystal, or a mass of transparent fluorite, into many pieces, some of them, or all, will be

more or less perfect octahedrons. Its cleavage is said to be octahedral. By putting a knife over the lines of fracture and hitting it sharply with the hammer one can cleave out perfect octahedrons. I have often done this when I had plenty of fluorite. It requires some practice but the skill for it is easily acquired.

Calcite is still more easily cleavable. Break a crystal into any number of small fragments, into powder even, and each small fragment or particle will be rhombohedral in form. I have broken up many a big crystal of uncouth appearance outwardly to get the transparent doubly refracting rhombs or rhomboids.

Hardness. Are not all minerals hard? No, some are soft and some are very soft, while some are hard and some are very hard. Water is a mineral, the most useful mineral in the world, and it is soft, even when it is hard water. Ice is hardened water—hard water one might call it—yet you can cut ice with a knife. Water is as truly mineral as iron or quartz, only it becomes liquid at a lower temperature than they.

The hardness of minerals is indicated on a scale of ten, with certain well known minerals named as the standard for each degree of hardness. 1. Talc, which one can pick apart with his fingers; 2, Gypsum, which one can scratch with his nails; 3, Calcite, which can be cut or powdered with a knife; 4, Fluorite; 5, Apatite; 6, Feldspar; 7, Quartz; which will scratch glass; 8, Topaz; 9 Sapphire; 10, Diamond. It is usually the crystallized varieties of these minerals that are used as standards. There are but a few minerals, including the most valuable precious stones, that are harder than quartz. Hardness is one of the qualities, but not the only one, that makes a stone precious. It must also be beautiful and rare. The hardness of a mineral can be approximately ascertained by

using the finger nail, a knife, a file, a piece of glass, a piece of quartz, or any hard gem stone that has a sharp point or sharp edge.

WEIGHT—Stones are supposed to be heavy as well as hard, yet some of them are light enough to float on water. Water is a comparatively light mineral and the weight, or specific gravity, of other minerals is referred to it as a standard. Calcite is two and three-fourths, fluorite three, baryta four and one-half, topaz three and one half, garnet three to four, iron seven and one-half, gold nineteen, and iridosmine twenty-one, times as heavy as water. The human body is just slightly heavier than water, unless, as in the Great Salt Lake, the water is heavily charged with mineral substances. Sometimes when returning from mineral trips my body has been so heavily weighted with minerals, all my pockets bulging with them, that I would have had no chance whatever for life if I had fallen into the water.

There are other interesting subjects connected with crystals, as Luster, Streak, Taste, Odor, Touch, the effect on them of acids, and of intense heat under the blow-pipe, but this is not a text book on mineralogy. For information concerning such things I refer the reader to the regular text books, especially to the series by the Danas, father and son.

CHAPTER IV.

Hunting for Crystals in Northern New York

A Pleasant Pastime. Some of the pleasantest and most thrilling experiences of my life have come from the pastime of crystal hunting. It has been a pastime, not in the low sense of passing away time, but in the sense of being a pleasant, healthy, innocent, instructive, and financially profitable recreation. It has been an avocation that has often rested and refreshed me when I was tired in, not of, my vocation.

I began when I was a boy. My home was among the archæan rocks of Northern New York, in Richville, St. Lawrence county, one of the very best counties in the United States for minerals, as any one can see by consulting Dana's list of mineral localities.

I caught, or inherited, a love for minerals from my mother, Sophia Murdock Cross, two or three of whose brothers were mineral collectors. When my mother returned from a visit to her childhood home in Vermont she brought a small box of specimens and gave a part of them to me. To my boyish imagination they seemed very wonderful. A little glass-covered box, kept on the parlor table, contained her little collection of choice specimens. As I stole into the darkened parlor on Sunday

afternoon in that blessed puritan home, and lifted the curtain to look at my mother's tiny collection, I used to wonder if it was right to look at them on Sunday. I long ago decided that it was right, but I have always refrained from going off to hunt for them on that day. My mother's little collection, some of which I still keep and treasure, was the germ of my own collection, and of the eight or more collections that I have put into college museums and elsewhere.

My elder brother, Judson N. Cross, made some shelves for his minerals, and of course I had to make some for mine. Those shelves are still in the boys' sleeping room in the old home, or were when I was last there.

A Baptist minister came to town and his only son, Safford Moxley, now a minister like myself, was a "scientific chap". We soon became chums and often roamed together over the rocky hills around our little village. We hunted for minerals and sometimes we "orated" to each other from rocky pulpit or platform.

My First Trip. One day my father took me four miles, across the Oswegatchie River, to an old fluorite locality. We picked up a peck of fluorite fragments that had been left by those who carried away the finest clusters. Remembering what pure delight that trip gave me I have often tried to give my own boys the innocent and profitable pleasures of scientific collecting trips.

A mile or so from that fluorite locality was a well-like hole where some one had dug for copper. My brother and myself went there and out of the loose red soil in the hole we dug large rough crystals of calcite.

Quartz. Then one day there was a fruitless hunt for a "diamond" or quartz crystal locality.

"Yes," said an old man, "there are diamonds there sure, for I have found them, myself". We failed to find

the place, partly because our directions were not definite enough—a lesson that I always remembered—and partly because some one was afraid we would find a treasure. A few years later I tried again, found the locality, and secured a few clear crystals which I still have. What a fascination there is about a reported locality that you cannot find! It is the same fascination that leads prospectors in the Rocky Mountains to hunt long and eagerly for "lost mines".

The Old Pasture. My father had a fifteen-acre pasture lot near his home. It contained a "sugar bush" of about fifty trees. While boiling sap and when going for the cows I searched about every boulder and ledge in that pasture. I could go now in the dark directly to the spots where I found indications of garnets, fluorite, hornblende, etc. That pasture is very clearly photographed on my mind. What a mystery hung about the creek in it, which at times disappeared under the rocks to re-appear on a neighboring farm. I believed, and still believe, that it flowed through wondrous caverns in the limestone ledge, but I could never prove it.

A Prospect Hole. There was a place a mile from our home where some one had dug and blasted for precious metals. Fair specimens of iron pyrites and of hornblende were to be found on the dump. Often since then, in the Rocky Mountains and the Black Hills, I have availed myself of the hard work of others by getting specimens from dump heaps. I have sometimes found valuable specimens in the rubbish that has been thrown away.

A Mineral Friend. A new family moved into a house across the road from my father's. I heard that the man was a collector of minerals, and though I was but a boy, I mustered up courage to go and call upon him. He

welcomed me cordially and took me upstairs to see his minerals. It was not a large collection but it contained the first really fine specimens that I had ever seen. What a revelation it was to me of the beauties of the mineral world! It contained some very fine specimens of calcite and galena from the Rossie lead mines, which have been closed now for nearly half a century. What glorious specimens came from those mines about the middle of last century, before Colorado was known or named! That mineral neighbor, Floyd Hamlin, and myself became life long friends. He soon returned my call and found in my little collection much more than he had expected to find.

Brown Tourmaline. He told me of a place in Gouverneur, three miles away, where I could find tremolite and brown tourmaline. When he moved away he gave me a large specimen of the tremolite. Mr. Nims of Philadelphia, New York, called to see my specimens and asked me to show him the place where that specimen came from. I did so, and received a shilling for it and for helping him lug a lot of specimens out to the road. He afterwards extensively worked the locality and probably sold several thousand dollars worth of single crystals and clusters of beautiful translucent brown tourmalines from that place. Some splendid ones went to Hamilton College. It became a famous locality. I learn that this year (1902) it has again been extensively and successfully worked. I often visited the place and still have some of the gem-like crystals that I found there. I went once with my sister, Lucy A. Cross, a mineral collector also, on her birthday. I found a fine crystal and gave it to her as a keepsake. Then I found a much finer one which I reserved as my own keepsake. I still have it, a twelve-sided prism, doubly terminated, translucent, of a

beautiful cinnamon brown color. Ah, what satisfaction it has given me in the hundreds of times I have held it in my hand to admire it or to let others admire it! It lies before me as I write, a thing of beauty and a joy forever.

Black Tourmaline. My father took me with him once to a religious meeting twenty-five miles from home, up on the hills of Pierrepont. At the farmer's house where we stopped I saw a shining black crystal of tourmaline. In reply to my inquiry as to where it came from they said it was found in abundance near an old saw mill about half a mile distant. The next morning they took us to the place. I dug the black brilliants for a half hour or so and then a thunder storm drove us away. I remembered the place for years and often wished that I could revisit it. I did so in 1871, while home on a vacation from teaching in Oberlin College. The crystals were remarkably smooth and brilliant and were found in abundance by digging in the dirt and decomposed rock. I gave some to a farmer in a distant part of the county. Mr. Nims, referred to above, saw them and followed up the clue until he found the locality, and from that place also he sold wagon loads of tourmaline crystals. It has been a famous locality, for no blacker, or more brilliant, or more sharply cut crystals of tourmaline are found in this world. I visited the place in 1871, 1875, 1883, and 1890, and always came away with hundreds of specimens, good, bad, and indifferent. I always greatly enjoyed cleaning the Pierrepont tourmalines. Water beautifully brings out their bright blackness, and if there are dingy spots on the crystals they re-appear very slowly after the crystals are washed. It was almost as much fun to clean them as to dig them. More than once I have taken back into my collection specimens that I had discarded, so

changed was their aspect after the rain had fallen on them.

Sharing With Mother. So long as my mother lived I gladly paid tribute to her out of my mineral finds. I owed her a mineral debt that could never be repaid. Often, when returning richly laden from mineral trips in the Rocky Mountains, I have wished that she were living so that I could send her some of my treasures. But her eyes have feasted for these many years on the matchless gems in the walls of the New Jerusalem.

Calcite. Once when I went home from the west she told me that the doctor across the way had found a lot of large calcite crystals in a big cavity, in a lime quarry near the railroad station, a mile distant. I went over to see the doctor, and sure enough he had a big heap of big crystals in his barn. Many times, until the cavity was exhausted, I dug therefrom great rough crystals, many of which I broke up to get the transparent rhombs. Once I put my hand into a muddy hole in that limestone rock and pulled out a large heavy crystal of green fluorite.

On one trip I dug in the old dump of the deserted Rossie lead mines, and skirmished with a silver pick among the miners' cabins around the Stirling iron ore beds near Antwerp. At the latter place I bought for two dollars a pan full of specimens that contained in their cavities fine brassy tufts of millerite, a mineral that was always in good demand.

Fluorite. When I was a boy a mineral friend said that fluorite was getting very scarce, the localities where it was found being about exhausted. He himself had helped to exhaust one in North Gouverneur, and I had heard my uncle tell how he had helped to carry a boat load of huge, green cubes away from Muscolonge Lake.

I have often since then heard it said of other minerals that they were getting scarce, but I have learned to have great confidence in the undiscovered resources of mother earth. Since I was led to believe that I was born too late to find much fluorite large quantities of it have been dug from Rocky Mountain mines and thrown on the dumps, while great quantities of fine clusters of that mineral, green, blue, purple, brown and yellow, have been imported from the lead mines of England. Many years after I was told that it was getting scarce some one found a cave full of it in McComb, only a few miles from my native place. Huge clusters, several feet high, of green cubes were taken from that cave. My sister and myself visited that cave twice. The last time the fluorite had about all been taken away. The first time we went there was still an abundance of it. We went down into the cave and saw where its sides and ceiling were lined with the massive green fluorite. There were spots and streaks where the green was of a most beautiful tint. The ground around the cave was strewn with quantities of the crystalline masses. We brought much of it away, and we broke up many pieces to get out the perfect octahedral cleavages.

Quartz. While living at Hamilton, N. Y., in 1875, my sister and myself went to St. Johnsville, thence two miles into the country, where a hospitable family lodged us over night and fed us without charge, and allowed us to dig hundreds of quartz crystals on their farm. The farmer also kindly carried us and our crystals to the station the next day. He was a marked contrast with the farmer who came at me swearing mad because I had been digging crystals, "picking up stones" as I termed it, in his pasture. He was going to fine me heavily. A soft answer turned the edge of his wrath, and a dollar bill to pay him for his

early morning trip further mollified him, so that he allowed me to depart with my sackful of choice specimens. When he found that I was the son of "father Cross," known and respected through all that county, he felt almost ashamed of himself. He told me that Mr. N. paid him five dollars a day for the privilege of digging crystals on his farm, and another five for his assistant. I asked him how much Mr. N. had paid him in all. It was quite a sum and he seemed to be proud of it. I convinced him that I was the cause of his getting all that money, as I had put Mr. N. on the track of that locality. If I had pressed the matter I might perhaps have persuaded him to pay me a commission on his receipts!

One summer day in 1875 a friend (Rev. W. D. Westervelt, with whom I afterward took many trips in the Rocky mountains) and myself went after some more of the famous Herkimer County quartz crystals, or "New York diamonds," as they are called. We went up in the edge of the North Woods, in the Adirondack region. The cars, the stage ride, and a brisk walk took us to the place in one day. We found the colorless, transparent, sparkling crystals in the loose soil that was full of pieces of sand rock. The crystals were formed in cavities of that rock, and when it crumbled they remained in the loose soil formed from it. We would turn up loose stones and underneath them were the shining crystals. We would catch up a handful of dirt and find in it a number of sparkling "diamonds." Every few minutes one of us would call out to the other: "Here is the prettiest one yet." And so the excitement ran high and the hours passed quickly. We dug crystals until it was dark, and then in our dreams we dug crystals all night. And oh, what splendid ones we found in our dreams! What great clusters of them rolled out of the dirt and sparkled

before our eyes! If only we could have made them real and kept them, what a collection we would have had! I always dig crystals in my dreams after I have dug them through the day, and they are always larger and nicer. It is one of my fancies that the crystals of my dreams actually exist somewhere in the earth, or in other worlds, and that perhaps I shall actually find them sometime.

At daylight we were out digging again in the crystal patch. It lay directly in and by the side of a cross country road that was not much used. If I remember right it was not so usable after we were through digging as it was before we began. We dug until the middle of the afternoon, when we each had a sack of crystals. We were eight miles from the railroad and there was no stage until the next day. We had to go that day. We could not walk and carry all those crystals, and we were determined not to leave them. We finally found a farmer who was very busy but who promised to hitch up his horse and take us a mile or two for a slight consideration. After starting we soon found out that temperance was his hobby, and we engaged him in a conversation on that subject that became so interesting to him that he took us six miles. Then we partly lugged and partly dragged our heavy satchels down the long hill into the railroad town. The cars did the rest.

And where now are the hundreds of crystals that we found on that trip? They are scattered over the land, in collections large and small. Some of them have been set in gold and are worn by fair ladies. I placed two beautiful ones, as flowers that I knew would not fade, in the coffin of "the little boy that died," and on his decaying breast they lie, waiting before they shine again until they reflect that "light that never was on sea or land."

CHAPTER V.

Hunting Crystals in the Rocky Mountains

In 1876 I removed from New York state to Colorado Springs, Colorado. I soon found that I was in a county as prolific in minerals as was old St. Lawrence County, while beyond that county was a vast mountain region teeming with mining activity. The riches of Leadville were to become known the next year, 1877, while Cripple Creek, within the limits of El Paso county, was not to be discovered for fifteen years. But many localities for minerals had already been opened, and in almost every house there were "specimens". It was the fashion, and no disgrace, to be a mineral collector. What finer home missionary field could have opened unsought for a man whose vocation was preaching but whose avocation was mineral collecting? I did not neglect my work, but during those thirteen years my vacations from my vocation were largely devoted to my avocation. On some of my mountain trips I united vocation and avocation, missions and minerals, in a delightful manner. Naturally my collecting fever broke out afresh and continued unabated during my residence there, and since removing my residence to the prairie states it has often drawn me back to the mountains for my summer vacations.

An Old Prospector. At Colorado Springs and at Denver I closely watched the mineral stores, and I sometimes bought quantities of fine things from certain old prospectors who brought their finds for my inspection. There was one in particular, Mr. A. Thiebaud, a Frenchman born among the Alps, one of Colorado's "fifty-niners", a quiet, plodding prospector, who knew how to find nice specimens, if any one ever did. In the past twenty-five years I have paid him many hundred dollars for minerals—one hundred and fifty dollars at one time for phenacite—and I have always found him reasonable in his prices and perfectly honest. For many years he lived in a log cabin on the famous Crystal Beds back of Pike's Peak, about thirty-five miles from Colorado Springs. His occupation was three-fold, raising potatoes, cutting railroad ties, and digging crystals. And what quantities of smoky quartz and Amazon stone (green microcline), what quantities of white feldspar, of green fluorite and beautiful gothite, in single crystals, twinned crystals, and great clusters, he has dug from those rocky hills! And how many rarer things he has found, topazes, phenacites, columbite, celestite, *et cetera!* And such odd forms and combinations as he would find and reserve for me, knowing that such things suited my mineral taste!

It was a rough log cabin in which he lived, miles back from the railroad, among the pines near the foot of Crystal Peak, or Topaz Butte. I have often visited him there. The accommodations were not of the best but the hospitality was fine. Sometimes there were more bedfellows than was conducive to comfort or to sleep. I remember that one night he struck a light and came to my relief. When he was through the rough bed was lurid with the blood of slaughtered victims. He occasionally built a new cabin for the sake of peace on summer

nights, and if I happened along I was invited to share it with him, or perhaps he would give me a tent in which to sleep.

But when the evening lamp was lighted, and he opened his boxes and drawers to show me the rare things that he had laid aside for himself or for me, then what talks we had about crystals and crystal hunts! His wife and children would listen eagerly, sometimes joining in the conversation, for it was a family of crystal lovers and crystal hunters. I gave them once a copy of my volume of children's sermons, CLEAR AS CRYSTAL. At a later visit I asked if they had a Bible in the house. The wife replied that they had none in English except CLEAR AS CRYSTAL. It was complimentary to my book but I took pains at once to see that they were supplied with a copy of the Bible.

A WEDDING IN HIGH LIFE. Sometimes I dug crystals myself, or looked over the old dumps, but generally I found it much cheaper to buy of my host. The last time I visited him the eldest daughter was to be married. They wanted me to perform the ceremony. Knowing that I was to be at Colorado Springs in June he wrote that if I would come they would fill my lungs with ozone and my pockets with crystals. Of course I went, and he more than kept his promise. The wedding was on a knoll under a great pine tree. To the east Pike's Peak rose sublimely majestic and impressive. Far to the southeast could be seen the smoke of Cripple Creek. To the south and west, near by and far away, were great mountain ranges. The next morning there were six inches of snow all over that region. It was a wedding in high life—over eight thousand feet high. The piece-de-resistance at the generous wedding dinner was a huge cake made by the bride and shaped exactly like Crystal Peak. When

we rose from the table it showed traces of extensive quarrying and tunelling.

But what heaps and full boxes of crystals there were on rough board tables all around that spacious yard! Only a collector can appreciate the exquisite delight of looking them over and taking one's pick. There were some huge crystals of quartz and twinned microcline for which I afterwards secured a purchaser that they might go to the museum of Oberlin college.

Smoky quartz has been found abundantly at the Crystal Beds, and in spots over all that Pike's Peak region. The first settlers and prospectors found many crystals on the surface. Now they are found chiefly in pockets that are excavated with much labor

Crystal Park. A mile or two south of Manitou and two or three thousand feet above it lies Crystal Park, a charming mountain valley far up on the mountain side. I camped there once all alone for a few days of rest. Then for a day or two I was joined by some of my Sunday school boys. When they came it was not so quiet. There was music in the air. They were the same boys who with me had discovered the Cave of the Winds at Manitou a few weeks before. If one wants some uproarous fun let him take a dozen boys out camping, put them to bed on the floor of the tent in two rows with their feet touching, then put out the light and try to go to sleep! The boys had a big crystal hunt one day, but they only gleaned where I had reaped. Before they came I wandered off alone one evening up the mountain side towards Cameron's Cone. I had previously searched through the park and found no crystals, for had not hundreds of collectors and tourists been there before me? So I took no tools that night, expecting to find nothing but flowers and scenery. But on a sandy slope I found one black

crystal of quartz. Following up the clue I found the nest from which it came, a big pocket under some pine roots. I dug with my fingers until it was dark and they were sore, and at daylight the next morning I was there again digging. Ah! but it was a rich find. What matters it now that the man to whom I entrusted the bulk of them, a box full, to carry to town for me, stole them and never put in an appearance? I had kept out some of the best ones, and no one can ever steal from me the delightful memory of those black beauties as they rolled out of the ground from under the pine roots. My cherished ambition to "find some for myself" had been fully gratified, even if I did find some of them for a thief. They were the only specimens that I have ever had stolen from me.

Tourmaline. In the summer of 1877, before there were any railroads in that part of Colorado, a dozen of us, mostly women and children, took a month's camping trip to Cottonwood Hot Springs and Twin Lakes. At the entrance to South Park over Puma Pass we stopped for dinner near what was then called Wilkinson's ranch. A boy showed me a crystal of black tourmaline. "Where did you get it?", I asked. "Oh, up on that mountain," he replied, pointing to a spot about a half mile away. As I was the leader of the camping party I quietly said that we would remain there that afternoon and night, as we could not cross the Park in a half day. I spent the afternoon on that mountain side breaking fine black tourmaline prisms, some of them several inches in length, out of milky white quartz. I also got specimens of the quartz with embedded crystals of tourmaline, the contrast of black and white making fine specimens. The quartz broke up readily and some of the black crystals were

veined with quartz. The quartz was the cement that united the pieces of the broken crystal.

I had the great delight that day, as I once had in Pierrepont, New York, of striking a fresh locality where crystals were abundant. I filled my horse pail half full, placing them in carefully and putting them under a stream of water that ran from a trough. When I returned I found that a freighter had carelessly poured them out on the ground so that he could water his horses with my pail. I gently gave him a choicely crystallized piece of my mind, but it seemed to make no impression on him.

Garnets and Topazes. When we struck the Arkansas River three days later I met some prospectors who told us of "Ruby Mountain" a few miles down the river —a mountain full of rubies! I had no time then to investigate the matter, but a few years later, when a railroad passed the spot, I went there several times. Twice I took a man to blast the rock for me. The mountain was a great ledge of volcanic rock, an ashy gray rhyolite, across the river from Nathrop. And what do you suppose we found in cavities all through that rock? Not rubies but precious garnet—spessartite—of a beautiful red color, very clearly cut, and very brilliant, and with them were small but very fine yellow topazes. Embedded in the cavities these crystals made fine specimens. I found one in which the garnets were arranged in a regular semicircle. Many fine specimens were spoiled by blasting, but I also secured many for my collection and for exchange.

Topaz. Speaking of topaz, one of the precious stones, it had not been found in Colorado previous to the time I went there, or if found it had not been clearly identified. The "smoky topaz", so called, was simply smoky quartz, or the cairngorm stone of Scotland. In the later seventies some one picked up a clear bluish

pebble in the creek near Colorado Springs and sold it for a dollar. The purchaser sold it for six or seven dollars to a local lapidary, who cut it and sent it east. It was pronounced a sapphire and was then valued at twelve hundred dollars by the owner. But he never sold it for any such price. It was doubtless a topaz.

PHENACITE. Not long after that Mr. Thiebaud found some crystals on Bear Creek, near Specimen Rock, which Professor Strieby of Colorado College called topaz. Some of them came into my possession, and with them some smaller crystals of a peculiar flattened form, found with the topaz. Mr. C. W. Cross, (no relation of mine, except that our fathers were both Congregational ministers and we both lovers of crystals) of the United States geological survey at Denver, identified them as phenacites, a sub-gem that had not before been found in America, and which had then been found in but four or five places in the world. I bought one crystal, the largest one found, for Mr. C. W. Cross for five dollars. It was afterwards valued at fifty dollars. With one of the crystals that I took east in 1883 I bought a gold watch for my wife. She was more reconciled after that to having minerals around the house, and still more so after I bought a piano with the proceeds from the sale of minerals.

C. W. Cross described those first Colorado topazes and phenacites in the American Journal of Science for October, 1882. Phenacites were afterwards found at the Crystal Beds, curious little "cart wheels," as they were called on account of their shape. They were found near Specimen Rock, south of Manitou, embedded in smoky quartz, and also in a coating of small mica crystals covering Amazon stone. Mr. Thiebaud found them in these two localities. Mr. Wanamaker found some of peculiar

form above timber line on Mt. Antero in the College Range. Along with them he found beautiful aquamarine crystals (beryl) of gem quality. The phenacites, or some of them, were evidently formed from the decomposition of the beryls and were deposited thickly on the partly decayed beryls and on the quartz crystals. I never visited that locality but I purchased many of those that Mr. Wanamaker found.

A Big Topaz. On one of his trips over Cheyenne mountain Mr. Thiebaud found some topazes, one of which was quite large, I think the largest ever found in Colorado. It weighed more than a pound. It was about the size and shape of a small smoothing iron. A part of the termination was missing, which of course greatly reduced its value as a crystal. I bought the whole lot and in looking over the pieces I noticed one that I thought might fit the broken corner. I put it on and sure enough it fitted it exactly. It increased the value of the big crystal many fold so that I sold it for fifty dollars. It was the most profitable specimen I ever bought, even after I had paid the finder considerably more than I had agreed to pay him. Some large and very clear topazes were found by Mr. W. B. Smith on the western slope of Devil's Head Mountain, a rugged peak in the foot hills, plainly seen from the cars as one goes from Denver to Colorado Springs. They were sold at high prices.

Elk Mountains. In the summer of 1880 I took a two week's vacation by going on a missionary trip to the Elk Mountain mining region, a new mining region that was just then attracting much attention. We left the cars at Salida and rode sixty miles in a stage, over Marshall Pass to Gunnison, in one day. After crossing Marshall Pass we had a narrow escape from the "road-agents." They were lying in wait for us in the thick bushes by the

stage road, but it was after we had passed. We were ahead of the usual time of the stage and we heard afterward that they robbed a man on horse back, who was about an hour behind us. The next day we took another stage for Crested Butte, where I made my headquarters While looking after some missionary enterprises I kept my eyes open for specimens.

O-Be-Joyful Gulch. One day after dinner I went up the river several miles afoot, then a mile or two up O-Be-Joyful Gulch. It was really a mountain valley, which some happy miner so named when he thought he had stuck it rich there. Then I climbed a very steep trail up, up a long ways, till I found myself in Redwell Basin, a huge mountain amphitheater near the summit of the mountains. It was about a mile in diameter and almost surrounded by a precipice of rock hundreds of feet high. At the point where we entered the amphitheater a large creek left it and went plunging down beside the trail in a sheet of white foam, which, when I saw it at a distance, I thought was a long drift of snow. In that strange uplifted valley I found some church members, and I also found on the dump of a mine all the clusters of finely crystallized iron pyrites that I could carry away. When I strike such localities, especially if I think that I shall never visit them again, I do not scrimp myself in the number of specimens that I get. I think of exchanges for years to come, and I not only fill my collecting bag, but my pockets also bulge with specimens. It was with a heavy load but a light heart that I trudged back that night over those long rocky miles, and my appetite for supper—well, it was as big in proportion as the *apatites* found in Canada.

A Rich Find. One day while walking through the woods on the eight-mile tramp from Crested Butte to

Gothic I found the richest silver mine in Colorado—while it lasted. The ore would have assayed over twenty thousand dollars to the ton. Unfortunately there was less than a ton of it. This was the way I found it: I had turned off from the trail and stooped over a mountain brook to get a drink from its icy water. On its pebbly bottom as I was drinking I saw two rounded and flattened pieces of silver that were curiously marked—two silver dollars in fact. Some thirsty traveler had been there before me and had paid a big price for his drink. I never found more money at one time, except in the form of crystals. I gave it to the home missionary society, for which I was working. Some other experiences of that missionary mineral trip hardly belongs to this book. They are "another story," and have been recorded elsewhere.

CHAPTER VI.

Hunting Crystals in the Rocky Mountains–Continued

Selenite and Calcite. One of the first localities that I visited in Colorado, and one that I visited often and always successfully, was twelve miles south of Colorado Springs and a mile south of Little Fountain Creek. I should have missed the way the first time I went if my informant had not chanced to mention a dead cow by the roadside. At one place our horse suddenly shied and jumped to one side. I made a big jump out of the buggy, but whether it was a voluntary or an involuntary jump I could not afterwards remember. Probably it partook of the character of both.

The pleasure and profit of another trip was nearly spoiled by having one of our horses get away from us. We corralled him a mile away. There was an extra bill to pay for a broken livery rig. The fun of still another trip was injured by our intense thirst that came on after our pail of ice water was exhausted. When we reached a well on our way home we drank as we never drank before. But such things are trifles compared with getting a big load of crystals.

On the surface of the ground we found fine clusters and perfect cones of that curious geological puzzle, "cone

in cone". In a deep gulch, worn through the clay beds, we found large concretions of black limestone which, when broken open, sparkled with crystals of calcite, with an occasional brilliant baryta crystal. On the clayey sides of the gulch, and in the hard clay, we found hundreds of crystals of selenite, or crystallized gypsum. Those that we dug from the hard clay were very clear and perfect. Some were twinned in the arrow head form.

The soil was so saturated with gypsum that I found small selenite crystals that had formed on an old piece of iron that some one had left there after using it a year or two before. It was one of those satisfactory localities that many trips and many collectors could not exhaust, and from which one could in those days always carry away hundreds of selenite crystals.

Soft Beryls. Speaking of selenite reminds me of an incident that occurred when I lived in Minnesota. An editor, who was something of a collector, told me that clear crystals of beryl—a very hard gem stone—had been found in a gravel bed a few miles out of the city. I thought it very strange that beryl should be found in those glacial gravel and clay beds, but he was so sure that it was beryl, having seen it himself, that I went with him to the locality. It proved to be selenite, a very soft mineral!!

Rose Satin Spar. There are many gypsum beds along the base of the Rocky Mountains. Through the gypsum beds run veins of satin spar, which is simply selenite in needle-like crystals, the needles being packed closely together. Beautiful specimens come from such veins, especially when they are of a rose color. The best rose satin spar is found near Pleasant Park, forty miles south of Denver. One day while camping in Pleasant Park I took the whole camping party, including six

children, to that locality. They all had the specimen fever, and what a chorus of ohs! and ahs! fell from their lips when they saw the rose red gypsum scattered profusely over the ground. Some collector had dug out more than he could carry away. It is used extensively by Denver mineral dealers in making fancy mineral work.

CELESTITE. One day I saw in a mineral store at Colorado Springs a geode of sky blue celestite, named celestite because of its blue color. They told me that it came from the Garden of the Gods, an appropriate place in which to find such a mineral. The Garden of the Gods covers quite a large region and it was only after much inquiry and two fruitless trips that I found the locality. On those two trips we walked right over the spot without knowing it. It was less than a quarter of a mile from the gateway of the Garden of the Gods. The cows had worn a path in the red soil and knocked out a few geodes, and that was practically all the development the locality had had when we found it. The nodules, buttons, or "pancakes" of celestite were of all sizes from a small button to one that I found that weighed eight pounds. They were found standing on edge in a narrow layer of red rock which projected a little from the red soil, and which was in a vertical position, as are the rocks on either side of the famous gateway. The nodules were solid blue celestite, or, if not solid, their cavities contained crystals of celestite. We dug out a large number. Then others found it out and hurried to get their share. On one day fifteen persons were there digging. After the owner of the ground put a stop to the digging one dealer went and dug by moonlight to avoid the watchman and the dogs. A mile to the north we found a vein of fibrous celestite, or celestine spar, as we called it.

MORE CELESTITE. Years afterwards I found another

good locality for celestite geodes in an old stone quarry at Wymore, Nebr., almost the only locality for crystals that I have found in this prairie state during a residence in it of ten years. Some of the geodes that I have dug out of the rock at Wymore are very beautiful. The delicate blue tint of the miniature Bunker Hill monuments cannot be surpassed. One of the geodes is the cast of a shell. I have not opened it yet, but I assume that the inside is very beautiful.

That locality has been to me a sort of oasis in the desert. I make pilgrimages to it for the satisfaction of my mineral hunger, and I pass many a rich grain field on the way, for Nebraska is very far from being a desert in the usual meaning of that word.

A Red Letter Week. That week which Rev. W. D. Westervelt and myself spent at Breckenridge, in the very heart of the Rockies, in the summer of 1882, is a red letter week in my memory. Bro. Bickford had written: "Come and help us dedicate our new church on Sunday and during the week we will go off on some long mineral tramps." We promptly accepted the invitation and went. One day we went several miles up French Gulch, out of which had come several million dollars worth of gold. We were not after gold, unless it came in our way, but in the bed of a creek we found a lot of "fool's gold," or iron pyrites. It was beautifully iridescent and we got so much of it that we had to ship it down by freight.

On another day we went up that same gulch, or valley, three miles, then climbed a mountain side, and for several hours we sat in the rain on the dump of a mine breaking up porphyry rock. We were letting clear cut crystals of feldspar out of their prison cells. Some of them were beautifully traced on the surface like forest rock. I thought to myself: "These crystals will be

scattered all over the land. They will lie on parlor tables or be placed in costly cabinets. One will go to the amateur's collection and another to some great museum that is visited by thousands. For years and perhaps for centuries they will be looked at, studied and admired. They will call forth exclamations of delight. They will suggest thoughts of God and of his creative skill. They will be things of beauty and joys forever. Surely, I am not only pleasing myself and getting innocent recreation and health by digging these crystals, but I am also doing a favor to my fellow men. I am adding just so much to the world of known and appreciated beauty. Thus I consoled myself for scratched hands and bruised fingers, for tired limbs and wet clothing.

DRUNK? As we three ministers plodded home that night five miles through pouring rain and splashing mud, with heavy loads of specimens, we were not at all dispondent. We enjoyed the experience and were happy. We met a wagon load of miners going out of town just as we were going in. They were full and noisy. Just then one of the ministers struck his foot against a root or stone and suddenly struck several clinodiagonal attitudes in a zigzag and rotary sort of way that naturally suggested unsteadiness. "What," said one of the miners, leaning his head out of the wagon, "you fellows drunk *already*?" I think we were intoxicated, not with strong drink, but with the ozone of mountain air, with the delights of nature, of crystals and crystal hunting in those grand old mountains. It took a long time to dry ourselves that night by the fire-place, which our host kept full of blazing pine. Our conversation was a curious conglomeration of morals and minerals, of theology and geology, of sermons and science.

The next day was rainy and we started for home.

At Rocky Point, where there were dizzy heights above and dizzy depths below, big rocks, loosened by the rain, had fallen on the track. They were discovered in time to prevent an accident. At the summit of Breckenridge Pass (11,500 feet) we passed through a hard snow storm. Snow and rain, clouds above and clouds below, swirling masses of clouds all around us, the swiftly rushing mountain streams left behind by the swifter train—so over the passes and through the parks and canons we came from the mountain tops down to our home in the Queen City of the plains—Denver. The several hundred pounds of minerals that we brought with us were a more lasting and a more satisfactory trophy than ever any fisherman or hunter brought back from a week's outing. And never in the memory of that week have we been haunted by the mortal agony of any of God's innocent creatures ruthlessly slaughtered by us. No little ones in some lonely den, or far away nest in the pines, ever wailed out their lives in agony for the dead mother that never came back to them because we had *killed* it. The fun and excitement that some of God's creatures get in killing others of God's creatures we got from pulling crystal after crystal, sometimes whole handfuls or great clusters of them, out of the earth. And then what after pleasures there were in cleaning them and bringing out their hidden beauties, in sorting them over and arranging them in one's collection, in giving some to friends and exchanging others with collectors! What pleasure too in the memory of that pleasant week, fresh after twenty years, and all freshly recalled by writing these lines, so that I can close my eyes and summon one of those friends from Maine and the other from Honolulu, and in their company live that week all over again.

ZIRCON. On the eastern slope of St. Peter's Dome,

in the rear of Cheyenne Mountain, at an altitude of nine or ten thousand feet, and in plain sight from Colorado Springs though ten miles away, was one of those non-paying mines, or prospect holes, that were the precursors of Cripple Creek, which is only a few miles over the range. In the rock that was thrown out on the dump were some small, transparent crystals which were being called rubies. I identified them as hyacinthine zircon. Some of them were of gem quality.

Cryolite. Some softer minerals were found close by which Mr. C. W. Cross identified as cryolite and its associated minerals. These had not before been found in the United States, Greenland being the source of the cryolite shipped to this country for practical uses. Mr. Cross found one new mineral in the cryolite series and named it Elpasoite after El Paso county. That locality has produced a great variety of minerals.

A Colorado Zephyr. Once a friend, Rev. Edward Hildreth, took me there one afternoon, driving within a half mile of the place. It was dark when we reached the spot and there was not wind enough to blow out a lighted match. We slept in the wagon—or tried to sleep. The zephyrs came before sleep did. That night the wind blew eighty-four miles an hour on Pike's Peak, and we were not far from Pike's Peak. It was a warm west wind, a sort of "chinook". We had plenty of bedding, so our suffering was not from cold but from our constant fear lest the wagon would blow over. We finally tied a rope to the wagon top and fastened it to a big pine log. Then we earnestly wished for day. There would come a lull for a few moments, and then far up the mountain side we could hear the next blast coming, roaring and crashing through the pines, drawing nearer and nearer, "louder yet and yet more loud", while we

braced ourselves and made ready to go over if the rope should break. With a noisy flutter of leaves and twigs and a wild swaying of tree tops the blast would go by. While we heard it roaring off to the east we could hear the next one coming. Towards morning it grew quiet and we dozed a little, but were up early and off after specimens.

At another time three of us ministers and two geological professors went to that locality. It took several hours for two strong horses to haul us and our ample lunch up the long steep mountain road—ten miles southwestward and one mile zenithward. The wagon was well loaded with specimens when we returned. We left it to the driver when we were part way down and plunged at a tearing rate down into and through the wild gorge called South Cheyenne Canon. Brother G. was a tenderfoot then. After his twenty-one years in Colorado he could probably keep up with the rest of us bettter than he did that day. A railroad now crosses that range and runs close by that locality.

A Lost Sole. On one occasion a twenty mile walk, all alone so far as human company was concerned, took me past that locality. I was returning to Colorado Springs from Seven Lakes, where I had spent a week in the clouds. I stopped and got some zircons, one very fine large one which I soon lost, but before reaching town I lost one of my two soles and had to go straight to a shoe store for a new pair of shoes. Shoe leather is one of the items of expense in hunting crystals in the mountains.

Rhodocrosite. Once upon a time—it was in the middle of the eighties—I was passing a jewelry store in Leadville when my attention was attracted to a specimen in the window. I turned and entered the store.

"What is the price of that specimen?"

"Seven dollars," was the answer.

"I will give you five," I said.

"No," said he, "the owner left it for sale and he will not take a cent less than seven dollars."

I was not sure what the mineral was, and I did not feel sure that it was worth even five dollars, and I left without buying it. But its rare beauty haunted me and after awhile I went back and paid seven dollars for it. It was a thick piece of rock about six inches square, having one side covered with transparent crystals of rhodocrosite, a carbonate of manganese. They were of a most beautiful rose red color, a color that charms the eye, as red roses do, and that is as beautiful at night by artificial light as by day. I think it was the most beautiful specimen I ever owned. Anybody, however ignorant of minerals, could appreciate its beauty. It was a specimen to rave over. It became at once the "piece-de-resistance" in my mineral case. I kept it and enjoyed it for some time. Then I wrote about it to George F. Kunz, a collector to whom I sent many choice Colorado specimens. He wanted to see it, promising to pay express both ways if I would send it on to New York. He also asked me to put a price on it. I sent it but wrote him that I did not wish to sell it, but if he wanted it badly enough to pay twenty-five dollars for it he could keep it. By return mail there came back, not the specimen, but a draft for twenty-five dollars. I have since heard of that specimen being valued at from one to two hundred dollars.

Two Days at Timber Line. When I bought that cluster of crystals I learned that it came from Alicante, about twelve miles from Leadville and a mile from the summit of Fremont Pass. The locality was near timber line and the altitude was about eleven thousand feet

above the sea. On two occasions I went there and spent a day in getting specimens of that beautiful mineral. Both times I came away with all that I could carry. To reach the spot I rode all night through canons and parks and over two high passes on the continental divide. Rivers dwindled to rivulets, and little brooks grew to be roaring torrents as we went up or down the mountain canons and valleys. Our train passed through one great drift, a jumbled mass of packed snow and pine trees, the remnant of an avalanche which had swept three snow shovelers into eternity the winter before.

I leave the train at Alicante and cross a mountain brook. It is the headwater of the Arkansas River. It makes more noise by far than it will thirteen hundred miles away where, as a great river, it enters the Mississippi. The mountains above me are covered with great snow banks that are furrowed by falling rocks and by rolling masses of snow. Up from the railroad track stretches a pine forest. At a certain point it stops, stops because it has reached that magic line where the storm king says to the trees: "Thus far and no farther." The trees obey the command, but myriads of lovely Alpine flowers bloom in modest triumph on all the highest slopes and cover them in summer months with glorious masses of color. The trees cannot in turn keep the frost king within his proper limits. Through the forest are wide open spaces, as though a giant had mowed a clean swath through the pines. And a giant did do it. It was evidently years ago that the resistless avalanche swept with awful force down through the woods, but the pines dare not grow there again. Not far from the railroad I find an unworked mine. Among the coarse rocks on the dump are the crystals that I am after. And on that dump, hammer in hand, I sit for hours breaking stone

and letting the beautiful crystals out of their prison homes. No human beings are in sight. My cares are behind me—over the mountains and far away. My mind is at rest. I listen to the stillness of those mountain heights, so silent and so grand. Yet in their way they speak loudly to me of Him who made and carved them, of Him who geometrized and painted the bright gems and put them here for me to find. They were made long, long ago, but their resurrection time has come at last, and the blow of my hammer is the trumpet of Gabriel to awake them to a new life.

Our Debt to the Miners. What a debt we who love minerals owe to the patient prospectors and hopeful miners who have located and developed so many mines in the mountains, in so many of which they have simply sunk their money with little or no return for themselves! How many trails they have made to otherwise inaccessible places! How many minerals, new and old, they have dug for us! They are after gold and silver, copper and lead—things that we care little for unless they come in the form of good specimens for our collections. Most of the crystals that we are after have no commercial value from their standpoint. They smile perhaps at our foolish, unpractical taste for such things. But they might smile more thoughtfully if they knew that the rejected stones that we carry away from their dump were to bring us sooner or later a hundred dollars, more or less. I presume that my two days' visit to the dump of that abandoned mine were worth that much to me, to say nothing of ozone, exhilaration and scenic delights.

I found on that dump one crystal, or cleavage, about half an inch long, wide and thick. It was a transparent, rose-red crystal at which I never tired of looking. One could imagine it to be a piece of fiery, red coal, formed

from a million petals of the most beautiful red roses that ever bloomed. It showed double refraction the same as calcite. I also found sphalerite, galenite, and fine bright unmodified cubes of iron pyrites.

Other Trips. Time and space and the patience of my readers will hardly permit me to tell in detail of other collecting trips. For instance, there were three trips to Bijou Basin after petrified wood that was finely agatized, jasperized and opalized; a climb after forest rock far up the steep side of Mt. Elbert, in returning from which I was caught in a rain storm and temporarily lost in a cottonwood thicket; visiting the petrified stumps near Florissant; a wild goose chase after tourmaline in that same region; collecting insect and leaf impressions in the shale of the old tertiary lake bed, and then sleeping in an empty house where we got still more insect impressions; roaming over South Park for moss agates and pebbles of blue chalcedony; searching the base of the bluffs north of Colorado Springs for blood red carnelians; searching a certain place near Manitou after heavy rains for onyx; finding smoky quartz in the roads at Glen Park and on the old shores of a nearly extinct lake on Bald Mountain; roaming over the pebbly prairies of Dakota, and searching the gravel beds and lake shores of Minnesota, for agates; driving to the foot of Mount Antero on a fruitless hunt for beryls, on which trip one minister in our party took cold and a few days later shot himself in the delirium of mountain fever; searching the mines and ore dumps of Leadville, Aspen, Central, Gothic, Red Mountain, Silverton, Telluride, and other mining towns; picking up specimens in the Grand Canon of the Colorado and around the Royal Gorge of the Arkansas; dickering for turquoise and pottery with Pueblo Indians in one of their curious villages; hunting for relics in the cliff dwellings

of Arizona; returning from a week's trip in Yellowstone Park with as many specimens as my conscience and the United States regulations would allow—perhaps a few more. There was however one other Colorado trip of which I must tell in a separate chapter.

CHAPTER VII.

A Crystal Picnic in March*

My son and nephew had it badly. My daughter and niece had it in a milder form and were somewhat convalescent, but were liable to have a relapse. Had what? The scarlet fever? The whooping cough? No, the specimen fever. They caught it from me. I have it all the time. This fever is contagious, as much so as playing marbles, or flying kites among school boys. It is very prevalent in Colorado. Few persons escape it who spend any length of time in that state. The railroad baggage men can tell by the weight of their trunks who of the returning tourists have had a bad attack of it. They sometimes swear about it.

The four children had long had the promise of a trip to the mountains to collect minerals. Eighteen days of March had passed and seventeen of them had been picnic days, so I told the children that we would go the next day. They could hardly sleep that night; some of them were up at four o'clock. They even lost their appetites, but they found them again on the mountains long before noon. There were six of us, four children, the principal of one of our public schools, and myself.

*First published in the Golden Rule.

We left the depot at eight and in less than an hour were at Golden, which is at the mouth of Clear Creek Canon. Just west of Golden are the foot hills, two thousand feet or more in height. West of them are the higher mountains. East and north of Golden is a long and broad plateau. It is called Table Mountain. It is seven hundred feet high and has been cut asunder by Clear Creek, making a valley seven hundred feet deep and nearly half a mile wide. Table Mountain is easily seen from Denver, fifteen miles away. It is a great lava bed, and it is full of the minerals that go under the name of zeolites. The best locality for them is at the foot of a precipice near the top of the mountain. The children made the climb of nearly seven hundred feet, over rough rocks, in nearly half an hour.

As we left the train we were surprised to see about twenty young men and young women, the geology class from Denver University, also leave the train and start for the same place, but the children reached it first. We found the University president on the ground blasting for specimens. We did not blast, but we searched among the stones, large and small, that others had blasted from the precipice. Good specimens could be found among the little stones. Or we would break up a large stone and find little cavities—caves the children called them—air bubbles in the lava rock, from those of tiniest size to those that were several inches in length. They were lined with crystals of chabazite, thompsonite, analcite, apophylite, mesolite, stilbite, calcite and other *ites*. Whack goes the hammer against the rock, and as the rock breaks asunder it reveals a number of crystalline and crystal-lined cavities that bring crystal sparkles to eager eyes.

As I had visited the locality several times I was appealed to on every side for information. What is this?

—and this?—and this? kept asking the children and the students, and the hard scientific names were flung around at a lively rate. It was better than a dozen text-book lessons on mineralogy recited in the class room. "What are these zeolites anyhow," said a certain minister as he was going with me to that locality." Are they some kind of fossil?" Before the day was over he had learned what they were so that he never forgot it.

In the meantime the geological professor is patiently drilling holes in the rock. He works in a dangerous place, where loose, overhanging rocks seem ready to tumble at the slightest jar. Every now and then we scamper behind the rocks and listen for the blast, and then watch the flying rocks. The echo of the blast, like a long peal of distant thunder, comes back from the mountain across the valley, then from the high foothills and mountains to the right, then from Green Mountain and from mountains further away.

One blast opens a large cavity full of beautiful white crystals of apophyllite. "That is worth five dollars if you can get it out," said an enthusiastic collector. "More than that," said the professor. Carefully and patiently he drilled around it until he got half of it out—a magnificent specimen. A blast is put in to get out the other half. The blast goes off, and the rock with the cavity of crystals goes off also. It describes a fine curve into the air, and is smashed to pieces on the rocks below. "Papa," said the eight year old boy, "that specimen isn't worth five dollars now, is it?" "No, my son, I think not." The hillside below the precipice is quite steep, and occasionally a big stone is carelessly started, and there is lively dodging among the collectors below to keep out of the way. Long before noon the children find a good deal of "apatite" and are not bashful in telling

us that they are "awful hungry." The professor and myself sympathize with them. Protected from the wind by the rocks, we sit in the warm sunshine and eat an early and a hearty dinner. After dinner we collect more specimens and carefully pack what we have. And then we climb to the top of the mountain, and romp and play, and inhale oxygen and exhale shouts and laughter, and explore the rocks, and roll great stones down the mountain. We see Denver in the distance and the great plains far beyond. We look up at the great mountains far beyond and above us, and down on the busy town below us, with its smelters and coal mines and railroads, its State Reform School and School of Mines, and its pigmies busily at work with dwarf horses. We think of the time when the rock beneath us was a stream of molten lava, and we speculate as to how long it took that mountain stream seven hundred feet below us to cut asunder the mountain of lava, and how long for the myriad cavities in the rock to slowly fill with such a variety of crystals.

Now we gather our forces together and march them down the hill, as we marched them up, in straggling array. For those of us who have corns on our feet it is harder to climb down the mountain than it is to climb up. We visit the glass works and watch with intense interest the process of making wine and beer bottles, and think with sadness of how often those bottles will be filled with the bites of serpents and the stings of adders.

We reach home before dark, tired, dusty and hungry, but happy and well. I feel that I have given the children a red letter day, one that will linger in their memories through life, and which, if their lives are spared, will be recalled with pleasure in their old age. Let us give our children as many such days as we can.

CHAPTER VIII.

Collecting Minerals in the Black Hills

The Black Hills are mostly in South Dakota. They are an island out on the great plains, one hundred and twenty miles long north and south, and forty to fifty miles wide. It contains five thousand square miles, and hence is about the size of Connecticut or of Palestine. It is a fresh green oasis amidst surrounding "bad lands" and sterile plains. Its hills are covered with yellow pine, which gives them a black appearance when seen from a distance. Its valleys are rich in gold and richer in arable soil. It is "a land of brooks of water, of fountains and depths that spring out of valleys and hills," and yet all but four or five of its many streams are lost in the arid plains after leaving the Hills.

It abounds in deep canons and pinnacled rocks, in rugged peaks and grassy parks, in wondrous caves and red valleys, in springs that are hot and healing, and in springs that are icy cold. Its rocks fairly shine with crystals, and all its valleys and hillsides are radiant with wild flowers. Deer roam through its forests and speckled trout are caught in its crystal streams.

Geologically and otherwise the Black Hills are an epitome of the great Rocky Mountain system. Long

geological ages ago the archæan rocks were lifted up through the Potsdam sandstone and the carboniferous rocks, and for long ages the water has been eroding them all. In the center are the archæan rocks—eight hundred and fifty square miles of them—while in irregular concentric circles all around are the tilted stratified rocks, whose inward facing walls girt the hills like a rampart, except where they are cut through by the streams in canons and valleys. All around the hills runs the Triassic Red Valley—race course, the Indians called it—with its red rocks and white gypsum and broad treeless levels. It is a rare place for geological study. He who runs, even at railway speed, can read the story of past ages. One can also see the crystals in the rocks as he looks from the car windows.

Just after one of my sons had been studying botany in the high school he and I spent two weeks in the Black Hills, he collecting wild flowers and I collecting minerals. Incidentally we took in scenery, trout fishing, the natatorium at the Hot Springs, and the Wind Cave. We had a royal good time. I must confine myself to an account of the minerals.

Geodes. One day we took the "tie train" eight miles up Spearfish Canon from Spearfish. It was a hard walk. On our return with a big load of minerals we utilized the passenger train, which accommodatingly stopped for us between stations. In a railroad cut we found a locality where quartz-iron geodes containing calcite were abundant. Evidently no one had preceded us in collecting them. Do any of my readers know by experience the pleasure and excitement of breaking open geodes? We enjoyed that experience to the full that day and we brought away a sackful of geodes.

Custer. We stopped for a week at Custer, altitude

five thousand feet, the original mining town of the Black Hills. It was a lively place in 1875-6, when five thousand men were there hunting for gold. It was a big stampede when all but twenty left for the new diggings at Deadwood, a thousand leaving in one day.

Sylvan Lake. A few miles from Custer are Sylvan Lake and the Needles, remarkably wild and romantic spots, far excelling the well-known Garden of the Gods and Glen Eyrie near Colorado Springs. We had almost reached the Needles on our trip to Harney's Peak, when our trail crossed a vein of rose quartz. The rose color was too pale, and so my boy, slipping on the pine needles, fell and opened a deep cut among the rosy veins of his wrist. A part of the rose quartz speedily changed to a deeper red. The wound was a serious one and we had to turn back. Six years later I completed that trip. That same morning my son found among the pebbles in the streets of Custer a fine specimen of free gold in quartz, something that many old residents had not found, though they had searched long and diligently. On my return I had a satchel full of choice specimens, besides one hundred and fifty pounds shipped by freight.

A Rich Mineral Region. The rocks around Custer abound in crystallized minerals. A few varieties are found in great abundance. They are not in very nice crystals however, and do not often have terminations, so that it is true in a double sense that there is no end to them. The granites are among the coarsest in the world. There is plenty of quartz, but quartz crystals are scarce. Beautiful massive rose quartz is found in veins among the archæan rocks. In many yards in Custer there are rockeries that are richly colored with specimens of it. Near Custer I found some fragments of opaline quartz I had one piece cut and it made a fine gem.

Mica is very abundant in the Hills. Many mines of it have been opened around Custer. Almost every ranch has one or two mica mines. At the lost Bonanza mine there were many tons of mica, among which I found many specimens containing embedded crystals of tourmaline that were flattened and brilliantly black. In two mica mines I found a curious combination in the same plates of black and brown mica, biotite and muscovite. The line of separation between the two varieties is generally well defined, both on the surface of the mica plate and also between the layers. They make interesting specimens.

Tourmaline is very abundant around Custer. In many places it is found in large masses. The crystals are much like those that I found near the entrance to South Park. The prism has twelve planes, with a low, three-sided, bevelled termination. Some very large ones were found by Miss Barbour of Nebraska State University. I found a very few doubly terminated crystals. Some of the prisms taper to a point, like some of the Colorado smoky quartz crystals. I saw one such crystal a foot and a half long. In one specimen that I found the crystals were about the size of a pipe-stem, and were so thickly embedded, parallel to each other, that in a space of eight inches square could be seen the ends of some sixty crystals. In one place at least, the New York mine, dark green tourmaline is found in a greenish mica. Near Custer there is a ledge of schist in which long needle-like crystals of tourmaline are thickly embedded, pointing in every possible direction. The crystals seem black but are said to be indicolite. In another locality, which I found, the black shining crystals are exceedingly small and shine brilliantly on the back ground of the mica-schist.

In the placer mines around Custer are found great numbers of very small garnets. They come from decomposed mica-schist and are found in the tailings of the washings. They are heavy and settle to the bottom along with the gold and stream tin. The largest one that we found was about a half inch in diameter, but most of them are so small that they are seen to best advantage under a common magnifying glass. Thus seen they are very beautiful, being blood red and some of them having twenty-four sides. Many of them have been worn into perfect spheres. A vial full of this garnet sand makes a good specimen for one's collection. In that region everybody calls them rubies. Some are found large enough and clear enough for cutting. Some very perfect small ones were found in the bottom of a spring. Larger garnets are found in the rock near Custer, but they are not very perfect.

In the streets of Deadwood I found limestone containing small cavities lined with calcite crystals. In the rock thrown out of a railroad cut in Spearfish canon I found some fair clusters of calcite, also good drusy quartz. In a bed of shale in the same canon I found good calcite geodes. Some of the geodes contained only quartz crystals, or quartz with calcite as a later deposit. In Wind Cave, twelve miles from the Hot Springs, I saw many beautiful calcite geodes, but could secure them only by purchase or exchange. Those geodes and the beautiful calcareous box-work formation seem peculiar to that cave, in which I saw very few stalactites. Crystal Cave, which I was unable to visit, is about twenty miles from Deadwood. It contains very extensive and beautiful deposits of dog tooth spar. Various forms of calcite crystallizations are found in the Bad Lands, near the Black Hills. Gypsum is of course abundant in the Red

Valley, but selenite crystals did not seem to be very common. I found some crystals of staurolite in the schist rock. I found feldspar but not in good crystals. In one mica mine they were taking out a good deal of spodumene. On the dump of another mica mine I found a goodly number of beryl crystals, some weighing two pounds or more. Very few of them were terminated and none of them were of gem quality except in small pieces.

Speaking of caves, how tantalizing it is to visit one and go through room after room that is covered with fine specimens and not be permitted to take even a poor one! Of course it is all right, for the finest cave would soon be stripped if each visitor took away one specimen. But what a pleasure it would be if one could help himself to anything he saw, and go out loaded down with specimens! Not many collectors have had such a privilege. I have had it and in the next chapter I propose to tell about it.

CHAPTER IX.

Discovering a Cave*

From 1876 to 1881 I was pastor of a church at Colorado Springe, Colo., one of the most beautiful residence towns in our country. The great mountains were so near that they often seemed like a big cloud in the west. Pike's Peak rose a mile and a half above us and nearly three miles above the sea. Among the foothills were wonderful canons, waterfalls and crystal beds. In plain sight, though five miles away, were the towering red rocks of the Garden of the Gods. A few miles north were the wierd rocks of Monument Park. I occasionally took some of my Sunday School boys, and sometimes the girls, on my holiday trips among the hills and rocks.

An Exploring Society. Finally I organized the boys into an exploring society, whose object was to camp out, explore the mountains, and collect specimens. The first trip that we took after the society was organized was a great success.

A Fissure Cave. It was five miles to Manitou, the great summer resort of Colorado. Close to Manitou is Williams' canon, which a small stream has cut hundreds

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of feet through the limestone rock. At the lower end of the canon, near the "Narrows," was a large fissure in the rock, called a cave. I had been in it with a friend and I took the boys one day to visit it and to explore the canon. My buggy was full of boys, while some walked and some went horseback. We took candles with us, and also a good lunch.

I left my horse and buggy at the mouth of the canon, and then we walked half a mile up to the "Narrows." There we found a half drunken man who demanded fifty cents for seeing the cave.

"That is too much," I said; "can you not let the boys in at half price?"

"No, you must each one pay fifty cents or you cannot go in."

I had not expected to find anyone in charge of that fissure cave, nor had I expected to pay anything for entering it, so I turned to the boys and said: "Boys, we will go on up the canon and discover our own cave."

And we did.

The boys were full of the spirit of exploring, and as we passed slowly up the canon I occasionally sent a squad of two or three boys, under the command of one of the officers of the society, to explore some opening that could be seen from below. Of course those openings had been often examined and we found no cave by means of them, though one of them opened back quite a distance into the rock.

A Windy Opening. Finally John and George Pickett climbed up into a very steep gorge that cut into the canon wall, and that was covered by a natural stone bridge, which was the top and edge of the canon wall. The boys called back to us that they had found a hole in the rocks. The rest of us climbed to the spot with great

difficulty. It was a very difficult place to reach, which explains why no one had found the cave before. We could look down through a sort of sloping tunnel into the depths of the canon. Looking straight up we saw the sky from the bottom of a deep rocky pit.

As soon as I reached the spot I felt a current of air coming out of the hole which the boys had found, and that convinced me that there must be some large cavities inside. There was an opening just large enough for us to crawl through on our hands and knees. Lighting our candles I led the way and the boys followed in single file. So I was the first person to enter that cave, but the boys and myself mutually shared the honor of its discovery.

As I proceeded I looked carefully for tracks of wild beasts, but I found none, and I never found any evidence that the cave had ever been inhabited by any animals except rats and bats.

Grottoes and Stalactites. We soon came to a large room with beautiful grottoes around it that were shut off by stony curtains, through whose thin folds of stalactite rock the light of our candles was easily seen. Fine stalactites were hanging like icicles from the roof.

Beyond that room was a larger one with many stalactites, and further on was a still larger room that was nearly fifty feet high. On one side of it there was what seemed to be the cascade of a river that had suddenly frozen. It was a mass of stalactite rock that had been slowly deposited there from the dripping water. Barely visible in the gloomy vault above was a huge stalactite several feet in length. At the right was another room, about forty feet long, that led to the edge of a deep well.

These rooms were but the ante-chambers of a great many others, some eighty in all, most of which were dis-

covered later by other people. Many of them were covered above and below and on their sides by wonderful clusters of stalactites, stalagmites, and the curiously twisted helictites. Some rooms were covered with a frost work of aragonite that sparkled like myriads of glittering diamonds.

THANKSGIVING. When we left the cave our pockets were filled with specimens. In the first room that we had entered I gathered the boys about me and got their promise to keep the whole thing a secret for a few days. Then I led them in prayer, thanking the good Father, who had taken many centuries in making that cave, that he had given us the privilege of discovering it. Then we crawled out and clambered to the bottom of the canon. I felt much relieved when I got that crowd of boys safely down out of that dangerous gorge with its overhanging rocks. We ate our lunch in a deserted cabin. How hungry boys do get on such a trip! And so do I.

Fearing lest the man below should discover our secret, we climbed the canon wall and went out another way. That man's business was utterly spoiled by our discovery. As soon as our genuine cave became known no one cared to see his fissure in the rock.

NAMING THE CAVE. We named it, at my suggestion, Pickett's cave, after the father of the two boys who found the opening. He was a consecrated and brave home missionary superintendent, who had been instantly killed a few months before by the overturning of a stage coach while crossing the range near Leadville in a snow storm.

ITS AFTER HISTORY. The cave was found to be on private property. The first man who took hold of it lost money. Then other parties bought it, fixed it up thoroughly, made new discoveries in it, changed its name to

Cave of the Winds, and in the twenty years since then have received a dollar each from scores or hundreds of thousands of tourists who have visited Manitou. We were permitted to add another to the many attractions of that wonderful spot at the foot of Pike's Peak.

Our Reward. Neither myself nor the boys ever got any money out of the discovery. Even the name that we gave it was changed, with no sufficient reason. In those days however, when everybody was helping himself to the contents of the cave, I came out of it again and again with all the stalactites I could well carry. It was a pity so to despoil some of its rooms, but as long as it was being done and I could not stop it I thought I had as good a right as anyone to the specimens.

The present owners have closed up the opening that we found and have made another near the top of the canon wall. The Grand Caverns are on the other side of the hill, or mountain, and are exhibited separately, for another dollar, though they are doubtless a part of the same series of caverns as the Cave of the Winds. None of the rooms in the caves are as beautiful now as when they were first discovered. Smoke and dust have sadly marred their beauty, though some of them are still worth seeing.

The boys who were with me that Saturday, June 26, 1880, were John and George Pickett, Bert Peck, Harry Johnson, George Neal, Arthur Tuttle, Bert Cone, and Lathrop Hill. They are boys no longer; they are men now. If any of them chance to read this account of how they and I discovered a famous cave let them take these lines as a personal greeting from their old friend and pastor.

CHAPTER X.

Some of My Crystal Friends

I have disposed of the main part of my collection eight times, besides giving or selling to individuals or schools a good many smaller collections. There are college and other museums in different parts of the country that I like to visit, because I find in them so many old friends that were once in my collection. I feel like shaking hands with them and asking them how they are treated by their new owners.

Auld Lang Syne. "Ah, my dear old smoky quartz crystal, I remember, if you do not, the hole from which you were digged. I remember just how you looked, half covered with dirt, when I pulled you out of the ground. And you, you bright topaz, I recall how shocked you were, and how you trembled all over, when my charge of powder blew up your home of ages and launched you upon a new kind of life. I did not blame you, it was "so sudden." And you there, cluster of analcite, how you winked and blinked with your many eyes when I uncovered your dark tomb, and a lightning flash of sunlight struck you fairly in the face! And you splendid old rhodocrosite cluster, do you recall the first time I saw you in the store window? It was a clear

case of love at first sight on my part. I could not resist the beauty of your rosy cheeks, and so I bought you at a large price, and afterwards sold you at a larger. Ah, you lovely celestite! I remember the very time I dug you out of the quarry. You thought to hide your sky-blue tints inside of a roundish mass of homely gray rock, but I knew your secret; I carefully broke the roundish rock in two and there you were! You could hide your loveliness no longer.

And you magnificent old Rossie calcite, so big, so clear, so finely twinned, how I coveted you when I saw you in my friend's collection! I paid five dollars in cash for you, and I would pay it again if your present owner would part with you.

A False Label. And you brilliant black tourmaline, who put that wrong locality on your label? I dug you out of the Pierrepont hills one fine summer day in the 'seventies, and a peck more like you. I know all of you by sight, for no other tourmaline locality produces the like of you. There for instance is one from another locality on your same shelf—well I declare, if it is not labelled as from Pierrepont and you as from South Park, Colorado! Some blunderer has exchanged your labels, and thus you are both made to act a lie. *I know*, for I took you both out of the ground in places nearly two thousand miles apart. You are both as black as black can be, but you from the east have an aristocratic, resplendent blackness, while you from the west are black in a moderate sort of way.

And if here isn't that big, doubly terminated, smoky quartz, supported on a stout quartz crystal stem. A geological college president once told me that you were the most unique crystal in my collection. You are certainly the biggest stem crystal that I ever saw or heard of. I ought not to have parted with you.

And here in this drawer is that finest aqua-marine beryl that I ever owned, the size of one of my fingers—no matter which one. You came from the snowy summit of one of Colorado's highest peaks. You were the biggest and finest of the whole lot that I bought of the hardy prospector, and I was so charmed with your bluish-green color that I wrote a poem about you, and it was actually printed in a paper! Ah, but you are a daisy! A Colorado blue daisy I mean.

"Why do you tarry so long in front of that case?" my friend asks.

"Because," I reply, "it is full of old friends of mine, everyone of which I have handled and admired scores of times. If they could speak I am sure they would welcome me and beseech me to take them home with me. Many eyes behold them in this public place, but not many of those who pass hurriedly by care to know the name, or birthplace, or parentage, or life history of these "old friends" of mine.

Sometimes I find them covered with dust, and and sometimes put in dark corners where they have no chance of being appreciated. Sometimes they are placed with homeliest side out, and sometimes they are thrown carelessly in with common stones, as though they were simply stones!

I am sorry for you my dear old friends. If I were rich and had a big house and did not have to move I would buy you all back again, and what good times we would have together again, as in the good old mineral years of last century! I would take good care of you—yes I would.

My friend is showing me his minerals and giving me a special introduction to his favorites.

"Now here", says he, "is a fine topaz that I ——".

I interrupt him to say: "Ah, yes! that topaz and I are old friends. I owned it years ago. I know it for sure by that ear mark. I paid the finder so much for it and I sold it to an eastern collector for so many dollars. Now how did *you* get it, and what did you pay for it?" He opens another drawer and says: "Here is a fine brown tourmaline that I value highly. See its rich cinnamon brown color."

"Yes", I answer, "it is nice, but by the way didn't I send you that crystal a few years ago?"

"Well, I declare, I believe you did."

I visit the Metropolitan museum in Central Park, N. Y., where are found the aristocrats among minerals, the chiefest and finest among tens of thousands, such as only rich men can buy. Ah, what glorious specimens! There is nothing common-place here, not one but would rule as king in any common collection. But can I believe my eyes? There is one of my old friends among the number, looking as grand as any of them! I rescued it from its earthy prison; I cleaned it; I fondled it; I proudly showed it to my friends; I owned it for a year; it was king in my collection; I gave it the place of honor, but I needed money and I sold it, and now it is one of the four hundred, an aristocrat among crystals. It is better so, for here it will rest, and be well cared for, and be seen and appreciated by the many, for centuries to come.

Showing My Crystals. By and by my friend returns my call and I show him my collection and call his attention to its special features and introduce to him my favorites. Oh, it is no trouble. The obligation is all on my side, for it is a genuine pleasure to show my crystals to a mineral collector, or to anyone who appreciates them, who knows a good thing when he sees it, but will not sieze a good thing when he knows it. Sit

there in an easy chair in the light and I will bring each drawer for your inspection.

Yellowstone Park Drawer. Here is a drawer of Yellowstone Park specimens, obsidian of two or three colors and some of it full of spherules, geyserite, wood coated with clear silica beads, rhyolite of different colors, natural and artificial objects coated with lime by exposure in the hot springs, pebbles from the lake, chalcedony, petrified wood, sulphur deposits, etc. Notice that beautifully banded agate that I picked up on the lake shore. I hunted for rare pebbles while others of our party went fishing. Our pleasures at the time were about equal I suppose, but where are their big fish now? *There* is my catch in that drawer, a perennial joy.

Black Hills Drawer. The next drawer contains only specimens from the Black Hills. (See Chapter VIII). There is plenty of tourmaline, from the coarse large crystals so abundant in the archæan rocks, to the brilliant flattened crystals, black and green, found in mica, and the needle like crystals of indicolite in the schist, some of them extremely small. There is plenty of mica also, biotite and muscovite curiously mixed in the same plates; there are big beryls, staurolite, graphite, calcite, and rose quartz of great beauty. But the prettiest specimens are the calcite geodes, the boxwork, the snow-white aragonite, and the "pop-corn" specimens—all from Wind Cave. That cave is in itself a marvelous museum.

Crystal Beds Drawer. This third drawer contains no specimens except those from the crystal beds near Florissant, Colorado. Here is a fine suite of smoky quartz crystals, about sixty in all. Note the peculiar planes on this one; see how thickly this one is covered on three sides with fluorite crystals, and how this one wears on its end a cap of crystallized fluorite.

This one tapers smoothly to a point; that one tapers by a series of steps. This one has a central crystal that is nearly covered with quartz of another color, and that in turn is partly covered by still another kind of quartz, all three being crystallized. This one was a broken fragment of a big crystal, but nature has covered the fractured side with innumerable crystal planes—a common phenomenon in crystals from that locality and from Hot Springs, Ark. This crystal was once broken in two, but nature with her own cement stuck the pieces firmly together again, but not quite evenly. I myself have blundered in the same way in trying to cement broken crystals. Nature and I do not always do things perfectly. Here is a crystal broken in two parts, not united again but having each broken end covered with many small terminal planes. You have heard of forms of animal life which, when cut in pieces, make a separate animal out of each piece. Nature does the same thing with some crystals; possibly she tries to do it with all when broken. This crystal is capped with brilliant gothite, and this black one is capped with a crystal of white quartz, which, like a hood, almost encircles the end of the crystal. The crystals in this drawer have all been selected from hundreds because of some peculiarity which they possess. In some cases, however, the peculiarity is that they have no peculiarity, but are simply regular, orthodox, six-sided prisms of quartz, terminated by two well-behaved six-sided pyramids, with no frills or freaks whatever. In this same drawer are the green Amazon stones, such a favorite with collectors, in single, clear cut crystals, in clusters, and in connection with quartz crystals. One crystal has been broken and mended by nature's cement, the same as the quartz mentioned above. There are also Baveno, Carlsbad, and other kinds of

twinned feldspar, gothite clusters, iron pseudomorphs, etc. It is an interesting drawer as showing, in part, what one locality can produce.

Another Drawer. In this drawer are some Iowa geodes that speak and sparkle for themselves. That big millerite specimen from Iowa is really fine. Did you ever see such a bunch of hair-like crystals, like a tuft of stony cotton, embedded in a limestone cavity? And see those cubes and octahedrons of lead, and that remarkably brilliant cluster of sphalerite, those fine chalcopyrites, and those silvery coated crystals of galenite—all from the Joplin, Mo., lead regions. And among all the golden calcites from that same region did you ever see a finer, clearer, more honey-like crystal than that one? I never did, and I have seen many. And here is a specimen that I am proud to own—a large, twinned, very clear calcite from the long-closed lead mine at Rossie, N. Y. It is coated on several sides with drusy calcite, in which are embedded numerous crystals of chalcopyrite. It is a white daisy from the stony pastures of dear old St. Lawrence Co. No, thank you, it is not for sale. I paid five dollars for it but it is worth more than that just to look at once in a while. I feel concerning it some as the man did concerning his Herkmier Co. crystals, of which he had thousands upon thousands of fine ones. He would not sell them, no, not one.

"But what will you do with them when you die?"

"Oh, I reckon I'll take them along with me."

Pyrites of Iron. In this drawer are my pyrites. If I only had all the really fine ones that I have sold one drawer would not begin to hold them. Here are some perfect cubes, and as brilliant as they are perfect. Here are some dodecahedrons, just as perfect and just as brilliant. Some of them have rare planes on their corners,

and some of them are interpenetrating twins. Here is a brilliant ball of pyrite, a globular mass of twins, set in a bed of small white calcite crystals, which in turn is set in a mass of red iron. This beautiful specimen of calcite crystals, sprinkled all over with shining pyrites, is the only one I have left of many that I bought of that friend (?) of so many collectors, P. P. P. You know him I dare say. Some of my pyrites are brilliant and beautiful and have the proper faces, but they are so distorted and unsymmetrical that it is a puzzle to distinguish the different planes and tell what are the regular faces of the cube.

Another Quartz Drawer. In this drawer there is nothing but quartz. And what a variety in size, form, color, brilliancy, gem quality and inclusions! I have sometimes thought that I would confine my collecting entirely to quartz. Here is one of those rare freaks of the Arkansas Hot Springs crystals, a perfect cross, formed by two crystals crossing each other. My friend, the Catholic priest, would doubtless pay me a good price for it, but it is just as valuable and significant to me as it would be to him. Note the crystals that contain inclusions. This one that is full of threads of byssolite is very wonderful when examined with the magnifying glass. And these limpid crystals with moving bubbles in liquid cavities—how interesting to watch their slow or quick movements as the crystal is turned! In some of the cavities are pieces of a black substance, probably bitumen, that rise or sink in the liquid. I have one crystal that shows two such pieces in one cavity. One rises in the liquid and the other sinks, passing each other on the way as the crystal is turned over. Some of these inclusions are visible only under the microscope. Some of them are minute rystals of quartz. They were surrounded by and buried

in a larger crystal. They could have no better burying place.

Here is a Herkimer county crystal that I call perfect. It is nearly an inch long and about a half inch thick. I paid two dollars for it. O yes, you can get fair ones of about that size for ten or fifteen cents, but they are not perfect. Perfection counts. It brings high prices in the market. This particular crystal has to me a double value. It is the one that I held in my hand as my text for fifty five-minute children's sermons, in all of which the particular moral truth taught by some Bible text was illustrated by crystals and crystal hunting.* See how it sparkles like a diamond as I turn it in the light. To my eyes it sparkles with the truth also. Here are some Herkimer county crystals lying loosely, or slightly attached, in little cavities in the sand rock. Such was the habit of all in that region. Thus set they make fine cabinet specimens. Here are some more odd forms of Colorado quartz, for example, a whitish crystal of quartz rising straight up from the rock and tipped with a black crystal of onegite. There are some stem crystals, one of amethystine tint, and two doubly terminated amethystine crystals crossing each other like the lettter X.

These hollow crystals of quartz from Arizona are exceedingly interesting. They seem to be formed by six flat crystals arranging themselves around a hexagonal space so that each one makes one side of the compound crystal.

And here are other drawers full of curious and interesting things, but let us pass on to the gem drawer.

*See book by author—*Clear as Crystal*, Revell & Co., 1886.

CHAPTER XI.

My Drawer of Precious Stones

At first it was a small drawer, nine by eleven inches, in which I kept my choicest gem-like crystals and my cut gems. But as they increased in numbers I enlarged their quarters until they filled a large drawer. In spite of depletions for college collections the drawer is still full, and crowded. If spread out as some collections are, there would be three or more drawers full. Let us spend a half hour in looking at them. If you enjoy seeing them as much as I enjoy showing them we shall both be surprised at the rapid flight of time.

Tourmalines. Here is a box of tourmalines with its smaller boxes for separate crystals. The larger and coarser tourmalines are in another drawer. Some of those doubly terminated ones from Pierrepont are perfect. I do not hesitate to apply that word to them. They were picked from many hundreds that I found. That brown beauty from Gouverneur is as long as my thumb and thicker. Take a glass and look down into its cinnamon depths as the sun shines upon it. Terminated tourmalines from the Black Hills are rare, but here is a *doubly* terminated one set in quartz, also a green one in mica from the same region. Here are yellow and white tourma-

lines from Dekalb, New York. See this striated quartz-veined prism from the South Park, this green prism with white and rose center from Brazil, these needle crystals of indicolite, and the rubellite variety from California so beautifully set in lepidolite. See these green, greener, greenest crystals, and some reddish ones, from Paris, Maine, some of them in the gangue and one of them cut as a gem. Tourmaline has been one of my favorite minerals ever since, when a boy, I used to find it on and in the rocks of northern New York.

Topazes. Topaz is another of my favorite minerals. I have a goodly number from different places in Colorado, some of them being among the first ever found in that region. Some of them are doubly terminated, and have the O plane on both ends. I have a few from Japan, some of them being of remarkable clearness and having many sharply cut planes in the termination. Others are from Mexico, detached or in the matrix. Those golden topazes are from Brazil, and that box of wine-colored and colorless crystals are from the Thomas Range in Utah. They are remarkably clear and brilliant, and I never tire of studying their many faces. See those green Amazon stones with topaz crystals attached to them. In this little box of cut topazes the best is one that I had cut from a Colorado crystal. It rivals the diamond in its brilliancy.

Phenacites. I have owned hundreds of phenacites from the Pike's Peak and Mount Antero regions, and still have a few good ones. The finest one is a good sized crystal attached to a smoky quartz, with a twinned phenacite beside the larger one. One would at first take them to be rhombs of calcite. Then there are some phenacites attached to, or embedded in, quartz and Amazon stone and albite.

Garnets. Here are my garnets, some very pretty

ones but nothing remarkable. That garnet sand from the placer mines in the Brack Hills is very interesting under the glass, filled as it is with minute red garnets, some rolled like pebbles and some with angles and edges unbruised.

Opals. Those cut opals from Mexico, and opals in the matrix, some of them containing needle crystals of rutile, are very beautiful, but those brilliant ones from Australia are, if possible, still finer. Henry Ward Beecher loved precious stones, and often carried some of them in his pocket. They had a soothing effect upon him when he was weary. After speaking in an English city several hours, in favor of the North in the civil war, against great opposition from a mob that was determined to put him down, he went to his hotel utterly exhausted. His wife thought that he would not sleep for hours, but he took some fine opals from his pocket and was soon absorbed in their wondrous play of color. They soothed him and quieted his nerves, so that after a little while he sank into a quiet slumber. I sometimes follow his example after the brain-exhausting services of Sunday.

See this Indian arrow head over an inch in length. It looks exactly like this piece of opal from Mexico. It is made either out of opal or of opaline glass. Some one in Iowa gave it to a friend of mine over thirty years ago, and that friend gave it to me.

Other Things. My diamond, sapphire, and spinel rubies are small but they are in crystal form. Those sapphire pebbles of many colors are from Montana. That star sapphire a half inch across is from Ceylon. It is cut so as to show a beautiful star across its face, which changes its place as the gem is moved in the light.

Those blue and green turquoises, some cut and some in the matrix, come from New Mexico. The beaded one

with a hole through its center I bought from a Pueblo Indian. He was drilling them with that simple but curious machine, the bow drill, or "malakates."

That perfectly transparent grass-green diopside, and that larger one that is nearly transparent, and that one cut as a gem, are all from Richville, N. Y., my native place. I think no finer diopsides were ever found. I have bought many from the owner of that farm. He prefers to do all the digging himself. That stony pasture lot on "Gimlet Street" has yielded him a good revenue in butter and cheese, in maple syrup and diopsides. Those transparent aqua-marine beryls, one of which is finely terminated, are all that I have left of many that I once owned. They are gems indeed. The one that I had cut is a gem of the first water. One of the crystals has a number of bright little phenacites on it. Some are found on partly decayed beryls. They were evidently formed from the decaying beryl, as beryllium is one of the elements of phenacite.

That free gold on quartz came from California in the early days of the California gold excitement. The other piece of quartz, so rich in gold, my son found in the streets of Custer. His sharp eyes detected what I had walked over without noticing.

The finest specimen in this box of cameos and intaglios is the one which, on a dark background, has two heads, a male and a female, the latter being cut out of white stone. The head cut out of tiger eye is that of a red man or of a black man, according to the way you turn it.

That round carnelian, that looks like a drop of blood, was polished before Christ was born. It came from the ancient palace of Sardanapolus in Asia Minor. How do I know? Well, that is what I am always asked

when I make the above statement. I reply that it came with that label from the private collection of old Pres. Hitchcock of Amherst college, a gift to me from his daughter.

There are other things in my drawers but the half hour is more than gone, for my friend to whom I am showing all these things, has frequently interrupted me to tell me what a fine specimen of this or that he now has, or once had, or found, or came near finding, or bought, or sold, or couldn't buy, or wouldn't sell, or saw somewhere, or heard of, or means to get. Come again. I shall be glad to tell it all over to you after you have forgotten it, or after I have forgotten that I told you.

CHAPTER XII.

How to Collect, Keep and Dispose of Crystals

Boys of a certain age have a mania for collecting. A boy's pocket is apt to be a museum. What particular line his collecting mania will take is often decided by what seem trifling circumstances, as the sight of another's collection, the interest of an older person, a gift, an article in a newspaper, or the finding of some curious thing. I have often showed my minerals to boys and then given them a few as a nucleus for their own collection. It is a good thing for boys to be interested in collecting something—stamps, posters, minerals, fossils, pictures, books, insects, or anything the collecting of which is innocent and instructive. Not many of them will persevere along one line of collecting through life, but some of them will. More than one noted scientist began his career by collecting when a boy. The boy who is interested in collecting is not apt to spend his time and money in foolish ways. The collecting fever may lie dormant for years, and then under favorable circumstances break out again, as mine did when I moved into a good region for collecting minerals.

What a person learns by collecting he is much more apt to remember than what he learns from books merely.

The collecting moreover will drive him to the books for information, and what he thus gets from books he will remember better than what he gets from books without the curiosity awakened by finding and handling objects. Encourage your boys, then, to collect, and, if possible, go with them on some of their collecting trips. It will help you and your boys to get acquainted—a very desirable thing.

We are to talk now about collecting crystals. I speak of crystals, for this book is more particularly about them, but I include all minerals of course, whether found in crystal form or not. Some very beautiful and valuable specimens are found in massive form.

A Beginning. The beginning of your collection may be something that you have found, or bought, or received from a friend. Suppose it is a crystal of quartz from New York, Colorado, Arkansas, or some other place. Study it up thoroughly. Learn all you can about quartz from dictionary, encyclopœdia, or any book on minerals to which you have access. Interview some professor or collector and ask him all sorts of questions about quartz. Become well informed on that one mineral. As you do so you will learn of other forms of quartz and gradually they will come into your collection. *Quartz and its Varieties*, by Albert C. Bates, will be a good book to get. If you are going to collect minerals you will need to get one of Dana's books, *Minerals and How to Study Them*, by E. S. Dana, or *Manual of Mineralogy*, by J. D. Dana, are good books for beginners. *Text Book of Mineralogy* and *System of Mineralogy* are for more advanced students. Get all of these books if you are able. A mineral scrap book is also a good thing. *The Mineral Collector* (1989 Broadway, New York City, one dollar per year), will be a valuable help, especially

because of its advertisements of minerals for exchange or sale.

As you get new minerals study up each one thoroughly. Read also, or study carefully, the introduction in your book on minerals that you may learn the general facts about crystal forms, hardness, cleavage, luster, etc.

If you meet some one who knows more than you do, do not hesitate to ask questions. You may thus show your ignorance, but the knowledge gained will enable you at some later time to answer the questions of others and thus show that you are not ignorant on that point.

Other Collections. A visit to a neighbor's collection, so much finer than mine, when I was a boy, greatly fired my zeal for collecting. It is true that when I visited the state collection of minerals at Albany, New York, I wrote home to my mother that she might throw my collection out of the window, but she did not do it, and I did not really mean that she should. The sight of finer collections will spur one on, while the sight of poorer collections will give one confidence. There is always something to learn from other collectors and their collections about localities, sizes, arrangement, labels, what is most valuable or most valued, besides enjoying the fellowship of mineral collectors.

Fellowship. If a man loves minerals, be he Catholic, Protestant, Mohammedan, or heathen, be he Republican, Democrat, or Prohibitionist, be he aristocrat or common laborer, be he professor or cow boy, be he millionaire or miner, I have a point of contact with him, and can enjoy talking with him, if his speech and breath are clean. For are we not both M. C.s, by the side of whom those M. C.s at Washington are stupid fellows? Many of them do not know a calcite from a fluorite, a quartz crystal from a diamond, or a piece of gold from iron

pyrites! If the other collector is better than you are, morally and socially, you may get good from him; if otherwise he may get good from you. So cultivate the acquaintance of collectors. A few of them will bear watching, but most of them are clean, companionable, whole-souled, generous and well-informed, at least along certain lines.

Collecting Trips. Take collecting trips as often as you conveniently can. The crystals that you actually find yourself, or dig laboriously from the earth, or blast from the rocks, will be more valuable to you, and more highly valued by you, than those that are given you or that are gotten with a "silver pick." You will not be apt to find new localities, though that is always possible, especially if you are in a newly settled region in the mountains or among the hills. Happy are you if you have a locality that is all your own. But ordinarily you will go to localities of which others tell you. Get very full particulars as to the exact location. Your informant may be able to go directly to the spot, but he may not easily tell you how to get there. "Go about three miles on the road, then through some woods and in a pasture beyond the woods you will find the place." That direction is very indefinite. Under it one might hunt all day and not find the place." The following is better. "Go two miles south on this road, to a corner where Mr. Smith lives in a red house. Turn to the right and go west one mile and a half to where the road crosses a limestone ledge. Follow that ledge north forty rods through a maple grove. In the center of the pasture lot beyond the woods is a big oak tree. Go there and you will see the place about two rods north." If you have a guide, or can go with an experienced collector, so much the better. If necessary go prepared with lunch

and drinking water. Ordinarily you will need a pick-axe, big hammer, small hammer and chisel, perhaps a hoe or shovel. I combine several of these things in one instrument which has been my companion in many a mineral trip in the mountains. I had it made to order. It is of steel, about ten inches long, a hammer head at one end and a tapering point at the other. It weighs about two pounds. The hard-wood handle is just the length of a cane. It serves the purpose of a cane in walking, of a grappling pick in climbing, also of a pick and a hammer, and of a handy weapon if I should meet a wild beast. It is well also to carry in one's pocket a "silver pick," for often, in miner's cabin or farmer's shed, you can buy good specimens much cheaper than you can dig or blast them. Sometimes the man or woman will appear to disdain money. "O, give it to the children if you wish." A little later the children surrender it to the parents. You will carry with you of course a bag, box or basket, in which to put the specimens that you get. Take plenty of old newspapers for wrapping. Some of the specimens may be soft and delicate and be spoiled if you have not plenty of wrapping material.

There are many ways of getting minerals at their localities. You may perhaps find them on the surface of the ground, or among a lot of pebbles, or in a gulch that the water has excavated. You may find them in a railroad cut, or on the dump of a mine, or in the ore bin. You may have to break up stones with a hammer, or blast the hard rock, or you may find it easier and cheaper to visit some neighboring farmer or ranchman or miner, and buy from what they have collected in leisure hours. You can usually do this at very reasonable prices, but not always. They sometimes have a very low, and sometimes a very exaggerated idea of the value of

specimens. It depends somewhat on how many "mineral cranks" are around. If they have the collecting fever you can often take along something to exchange for what they have. But do not lie to them, or cheat them.

How Many to Get. While you are at the locality get all you can. Do not be satisfied with two or three or a dozen. You can give away the poorer ones and the others may last you for years in exchanging. If you cannot carry away all that you get hide the rest, or cache them, in some near-by place. No wild beast will devour them, as a bear devoured our string of trout that we left in a hollow stump near Cottonwood Lake in Colorado. Some other collector, however, may find them and benevolently assimilate them to his own collection. Neither he nor you will regard it as a flagrant case of stealing. Are not all of us collectors constantly taking for ourselves things that Nature has carefully hid away in the ground? She is great on caching her mineral products. How she must laugh at the way we miss some of them, even after we are very "hot."

A Mineral Account. Keep an account of the expense of your trip, and of all your purchases and sales, so that you may know at any time how much your collection has cost, or how much you have cleared when you sell it. You will not count your time. The recreation and fun of the whole thing pays for that many times over. I find that in the last twenty-seven years my mineral collecting has—cost me? No, it has netted me an average of more than one hundred dollars a year, besides what I have on hand, and besides a $460 collection that I sold, but for which I never received the pay.

Cleaning Minerals. When you have brought your specimens home the fun has only just commenced. Some need much cleaning, some but little, and some need none

at all. Some need only water and a stiff brush, or a good stream from the hydrant. Some need to soak in water. Some need acid to get off the iron rust. Some need to be slowly boiled, perhaps for days, in dilute acid. Many of the fine crystals and clusters of quartz and Amazon stone from the Crystal Beds near Florissant, Colorado, have been cleaned in this way. They had to be dug from the earth and then the earth dug from them. They were anything but beautiful when first found. It is a positive pleasure to unearth hidden beauty. Beautiful crystals and the light were made for each other. It is a pleasure to bring them together for the first time, just as it is a pleasure to introduce to each other two persons naturally fitted and actually destined to be husband and wife, or to pronouuce the words that make them such, as has often been my privilege.

Trimming. Many specimens need careful trimming with a hammer to get rid of needless rock. Many a fine specimen has been spoiled in the process. There is a trimming machine which slowly and without shattering blows, cuts off or crushes off the redundant rock.

Mineral Baths. Minerals need an occasional bath, just as people do, especially if they are where the dust settles on them. Some minerals, like black tourmaline, will appear more brilliant for days after a good bath. Some crystals need to be kept constantly in water to show off their beauty. When dry they are like fish out of water.

Where to Keep Them. As your collection grows it will become a problem to know where to keep it. Your wife or mother may decidedly object to having your specimens lie around where they will gather dust. A spool drawer, such as merchants have, is a fine thing for a small collection, if the specimens are not large. I use

several for my exchange duplicates. I once had a large case made, with double glass doors. It was seven feet high, five feet wide, and one foot deep. The shelves were an equal distance apart, but on each shelf were from one to four steps, the lower and upper shelves having fewest steps, on which I put large specimens, the middle shelves having more steps, for smaller and choicer specimens, placed where they could more easily be seen. Such a case shows one's whole collection at a glance, which is often a great saving of time in exhibiting it.

I now have, however, a set of drawers. The frame is $6 \times 3\frac{1}{3}$ feet, and twenty inches deep. It rests on very heavy castors and has a secret chamber opening from the top. The three lower drawers have a clear depth of four inches, the next four a depth of three inches, and the five upper ones of two inches. Big specimens can be put on top, but in these later years I avoid big specimens and collect small and choice things, for which drawers are better.

If one can have a mineral room with good windows, or with a skylight, it is a comfort. At any rate a mineral case should be placed opposite a window, or where the light will fall directly upon it. The more light the better. Give them the light. They lived long enough in the dark. A few minerals, however, need to be protected from the glare of the sun. Some must be kept in the dark.

Arranging the Minerals. You can arrange your collection by localities, or on the principle of scientific classification, or with reference to its showing off well, or you can combine these plans, as I am doing at present. For example, I have one drawer devoted to Yellowstone Park, one to the Black Hills, and one to the Colorado Crystal Beds. I have ores in one drawer, quartz in

another, or in two, and in another the spars, such as calcites, fluorites, selenites, etc. One drawer is devoted to gem stones and some very choice crystals, others to specimens of several kinds. The smaller specimens I put in flat boxes of different sizes that can be easily taken out for examination; single crystals, or a number of small ones of one kind and place, being put into still smaller boxes, quite a number of which are contained in each larger box. Most of the boxes have covers that I usually leave on the bottom of the box.

Of course the best side of a specimen must face outward, or upward. Who cares for the photograph of a friend's back? It is the face that we want to see. Specimens should not crowd each other—as mine generally do. I am prone to act on the principle that there is always room for one more. Specimens should certainly not be piled on top of each other. They will scratch each other even if they do not fight, and it is difficult to pick them up for examination without starting a rock-slide.

Isolation. Have you not noticed how much finer a specimen looks in the field, among common stones, or all by itself, than it does in a drawer with other specimens? Fine specimens seem to take the shine off from each other. Hence it is well to surround a fine specimen with more common-place ones, or give it plenty of room in a box or drawer by itself, or hold it in your hand away from the others when you show it. This is one reason for not crowding specimens. Give them a good background, or framing, as you do a picture or a jewel. You do not cover your fingers with rings. One is enough if it contains a brilliant.

Combinations. This rule however is modified by another and opposite one, that of massing crystals as you do flowers in a bouquet, or pearls on a necklace, or faces

in a group. In such cases, however, the crystals should be of about the same size and color, or if of different sizes and colors, they should be arranged somewhat in order of size and color. One crystal of quartz from Herkimer county is not enough for me. I want a bottle full, a box full, a drawer full if possible. No two of them are alike and I get much pleasure in looking at and into each one separately, with my glass if they are small, and then at all together to get their combined effect. Nature makes not merely single flowers, but clusters of them, and clusters of clusters, and whole beds and gardens and fields of them. She believes in bouquets. The compositæ family is a large one. She also gives us rock surfaces, geodes, cavities and caves that are studded and lined with innumerable crystals of one kind of mineral. And they are not always of one color. I have had rhyolite cavities that contained colorless and golden-yellow topazes side by side.

One disadvantage in massing crystals of one kind is that when some people see them they think that you might as well as not give them one or more. They might as well ask you for a piece of your ten dollar bill, for one of your ten fingers, or for one of your ten children if you are so fortunate as to have that many. In some such cases ten times one is more than ten. It is ten ones plus the combined effect and potency of ten. The Pleiades is more by far than the number of separate stars in it.

Labels. Of course you will label your crystals. You may wish to sell them sometime, and it would detract much from their value if it was not known where they came from. You yourself may know the home and history of every one of them, but your heirs and executors will not know. There are different ways of labelling specimens. Some paste the label on the specimen, but

with some specimens that cannot be done. Some paint numbers on them and put the full description opposite those numbers in a book. Some put a written or printed label under the specimen, which is my way, varied by writing a label outside or inside of a small box that contains a specimen. Some put each specimen on a square piece of a board and paste or paint the label on its sloping bevelled edge. A full label should contain the name and its synonyms, chemical composition and locality. Where and how, or of whom and at what cost it was obtianed can be put on the back of the label. The history of a specimen is sometimes of great interest, especially if it is a very valuable specimen, like a costly gem.

Exchanging. *The Mineral Collector* or *Casino's Directory of Naturalists* will furnish names of persons in different parts of the country who have minerals to exchange. It is well to ascertain the standing of a person before exchanging with him. If you write first, state clearly just what you can furnish, and in what size, quality and quantity. If he agrees to an exchange you are to send your package first, prepaying postage, express or freight. Be generous, rather than stingy, and try to get the reputation of being a good person with whom to exchange. Do not send worthless stuff, though of course collectors have different standards and differ much as to what is worthless. If you do not get a fair return do not make a big fuss about it, but accept it as one incident in a collector's career. If a person proposes to you an exchange he will of course send his package first. Two friends often share each other's acquisitions without keeping any account as to how they stand. That is a pleasant way to do if they are about equally situated with reference to getting things.

Exchanging is one of the chief ways of building up

a collection, but it has its drawbacks. I have sometimes received more value than I have sent, and I am sure that I have sometimes sent more than I have received. If in some cases I have sent less it was not intentional, and I hereby express my regret for it.

Exchanging with mineral dealers is apt to be unsatisfactory. Your and their ideas of values are apt to clash, but there are exceptions.

Buying. The best way is to go direct to a mineral store and select what you want, or what takes your fancy. Minerals are difficult things to describe in a circular or catalogue. The next best way is to have a box of specimens sent you on approval, which mineral dealers are willing to do if satisfied that you are a reliable person. You are supposed to pay charges both ways, unless you buy a certain stated amount of what is sent. If you can buy of those who collect in the field you are liable to do much better, especially if you buy a whole find. If you choose you can of course buy a whole collection of a dealer, all labelled and classified, at any price from one dollar or less to one thousand dollars or more. Schools often do this, but it is pleasanter for a private collector to gradually gather his collection and see it grow.

Selling. You may wish to sell your collection. Some never sell but leave it to be scattered after death, or perhaps sold for a trifle. My collection is always for sale if I can get my price. I keep it for a while, enjoy it, and then sell it to make room for new goods, as the merchants say. I have it understood that I reserve a few duplicates or special specimens. Thus I have a basis for a new collection. My mineral drawers abhor a vacuum and they soon fill up again. Though at first the material is not so choice, yet it gradually grows better as I weed out the poorer specimens. By selling my collection I get

money to buy new and better specimens. Unlike some other things a collection is worth more than the sum total of the value of the specimens taken separately, especially if it is rich in some special lines. It is worth that plus the work and skill of getting it together. If you sell a collection to a scientific society or college you put it in a safe place, where it will probably remain, perhaps unbroken, for an indefinite future. Sometimes you can interest a rich acquaintance who is friendly to you and to some college, to buy it of you and present it to that college.

Showing the Collection. It would hardly be worth while to gather a collection if no one was to see it but yourself. What are our choice things worth if we cannot share with others our enjoyment of them? All collectors whom I know are glad to show their collections to persons who appreciate them. But oh! what a difference there is in persons who look at them! Some gaze at them as solemnly and silently as they would look at a corpse. One can feel that they are saying to themselves: "What vanity to spend one's time and money on such trifles!" or: "This person must be a little cracked to get so interested in stones." Others take them all in at one rapid glance and then exclaim, "What pretty stones! Where did you get them all?" Some pick them up and sling them down roughly as though they were nothing but stones. You tremble for your darlings while such persons are around and you close the doors or drawers as soon as you can. You do not care to cast pearls before—people who do not know that they are pearls. Others know just a little about minerals and they tell it all, and more too, as soon as they can. They make remarks that reveal woful ignorance. They talk of crystal as though it were some special kind of mineral, and of mineral as though that term

meant nothing but ore of some kind. They look very skeptical when you tell them that those sparkling crystals have not been cut and polished by man but grew in that way. They do not know that Nature is chief of lapidaries. Some are dry scientists who talk learnedly far above your level. They can scarce conceal their contempt for amateurs like yourself, or for specimens that have not a strictly scientific interest. Others admire your beautiful things in a very gushing sort of way, and exclaim loudly over everything that you show them, and would fain make you believe that yours is the most beautiful and wonderful collection they ever saw. They make one tired and nervous. Then there are others who covet your treasures, and seem to turn green with envy, and wonder why they cannot find such things. Others ask if you are not afraid that they will be stolen, and what you paid for them, and what they are all worth, and what you are going to do with them, and other impertinent questions. Then there are collectors with plenty of money who wish to buy your half dozen best specimens but have no use for the rest. Then perhaps a well-to-do friend comes—such an one came to me once—who suspects that you may need the money that your collection is worth. He quietly asks for what you will sell the collection. "Five hundred dollars," you reply. "Well, I guess I will take it. Here is a check for half the amount. You can pack it and send it on at your leisure."

May that man's tribe increase! Next to such an one send me to see my collection the amateur who knows just about as much about minerals as I do, who is gentlemanly and a good listener, who appreciates my collection as a whole and any special features to which I may call his attention, who has not "got a nicer one at home," or if he has he does not tell me so, who calls my baby the fin-

est specimen in my collection, and who offers to send me some fine things that my collection needs, no matter if I cannot give him an equivalent just now, he has more of that kind than he needs anyhow. When such an one comes to see my collection I feel like saying to him, as a good old German woman said to me when I made my first pastoral call on her: "Come again; *come all the time.*"

CHAPTER XIII.

Lessons From Crystals.

I know that there are sermons in stones, not because Shakespeare said so, but because I have found them there in abundance, just as in some rocks I have found an abundance of crystals. In each case however I have had to dig for them, and then either clean or polish them so that they might appear well. Just as it is a pleasure to show one's choice crystals to those who appreciate them, so it is a pleasure to tell to those who appreciate such things the lessons and stories that the crystals have told to me as they and I have sat for hours in silent communion with each other.

The subject is a large one, and if fully developed would fill a large book. Many lessons can be learned from granite, sandstone, marble, slate and other rocks, but we must limit ourselves now to crystals, those stony flowers of the earth that were designed to teach us moral truth, as truly as were the flowers and the stars.

Many arbitrary and fanciful qualities have been attributed to the precious stones, as ill luck to the opal, temperance to the amethyst etc.; but in those fancies we

take no stock. The crystals and gems teach us enough real lessons without inventing imaginary ones. In trying to impress us with the glories of the New Jerusalem John used mineral substances—clear crystals, precious stones and gold—more than any other things. We thus have good authority for using crystals, as well as stars and lilies, in illustrating moral truth.

Reminders of God. First of all the crystal should remind us of God. The polished diamond reminds us of the patience and skill of the lapidary. So the stones that are cut to such perfect angles, and that are polished so brilliantly by the hand of nature, should remind us of Him whose hand all nature is. Men once looked through nature up to nature's God, but now, as a result of the emphasis that thoughtful and devout souls are placing on God's immanence, we may look into nature at nature's soul, which is God. And we can do this without being pantheists.

If the fading flower can be called one of God's thoughts, how much more may we regard the enduring crystal as a poem that God has breathed into stone, the condensed poetry of mathematics and chemistry! If such thoughts of God should make us think of him, we may remember with joy that we too are his thoughts, and that he never forgets his own thoughts. "The Lord thinketh upon me."

Loving the Beautiful. The crystals teach us to love the beautiful and they give us something beautiful to love. They are a part of "whatsoever things are lovely," upon which we are told to think. We must think on such things in order to get God's thoughts out of them. The myriad beautiful things in this world, and our natural love for the beautiful—so apparent in a little

child—were made for each other. God hath joined them together; let no one put them asunder.

The beauty of the crystal is perennial. It can be enjoyed in winter, when the flowers and birds are gone from us, in the daytime, when stars are not seen, and some of them, the phosphorescent ones, even in the dark. I often carry crystals or polished gems in my pocket, and I find them entertaining companions in lonely hours. They are full of concealed pictures and hidden beauties that appear only on very intimate acquaintance. They are a miniature museum, library and art gallery combined. The magnifying glass which I always carry in my pocket is an open sesame to wondrous landscapes of forests and mountains, to glowing sunsets, to rare old inscriptions and to wondrous architecture. Crystals are better companions than some persons are.

Transparent Souls. The beauty of some crystals is in their perfect transparency. They are clear, just as our minds and souls ought to be. They have kept themselves pure. You can see other beautiful things by looking through them. They transmit light and beauty without distortion, being thus unlike some of the old fashioned panes of window glass. They even multiply beautiful things according to the number of their faces. We love to look at, and look into, such crystals; and still more do we love to look at the clear-eyed boys and girls, and down into the liquid depths of their clear, honest souls, where there is no mud, no deceit, no twisting and turning of the truth. Alas that they do not all remain so! And glad are we that there is a clarifying power and process by which the souls that are befouled with sin can be made clear again.

Reflecting the Light. The clear crystal reflects

the light, as well as transmits it; and so should we. Thus it shines more brightly, and can be seen much further, than a dull pebble. I have been in caves that were covered with myriads of crystals that gloriously reflected the light of our torches. They did it the first time they tried, for they were made to do it, although ages passed before they had the opportunity. They were patient and their time came at last.

Though growing in caves of darkness,
Where rays of the sun came never,
They were made for the light, as we
Were made to love God forever.

My quartz crystals reflect the light from every one of their eighteen faces, and so should we reflect the light of truth from every part of us, from every faculty and from every side of our nature.

Unity in Variety. Unity in variety is a law that pervades all nature. No two leaves or flowers, trees or hills, pebbles or crystals, insects or men, are exactly alike. In my drawer full of eighteen-sided quartz crystals no two are exactly alike, yet they are all built on the same geometric plan. If each person has eighteen sides to his character might they not approximately be called by the following names: joy, peace, patience, gentleness, goodness, faith, hope, meekness, temperance, truth, honesty, fidelity, obedience, humility, chastity, courage, forgiveness and piety? Have I left out the most important? Yes, but in name only, for all these are but eighteen other names, or synonyms, of love. There is room in every soul for all of them, and there is room among men for almost infinite variety in their arrangement and emphasis, without crowding any of them

off, or down to a mere point. Each is a surface from which love is reflected; each is a window out of which love looks.

The Rough Side. Most crystals are rough on the side where they were attached to the rock. We hide that part when showing them. It is that part of our souls that is attached to the world that we do not like to exhibit to others, but after which we ourselves should carefully look.

Enduring Hardness. The scale of hardness for crytals ranges from one to ten. Some crystals you can easily cut; others can easily cut you. Put a lot of crystals of different minerals into a box and shake them long and hard. Some will come out unscratched, and some very badly scratched and bruised. In the constant shaking and incessant friction to which souls are subjected in this life many are badly bruised and broken. Others endure hardness, in body, mind and soul, as good soldiers. These latter endure because they have in them an element of strength, like the silica found in some crystals. A higher strength is made perfect in their weakness. Temptations scratch some souls as little as glass scratches the diamond.

Beauty out of Baseness. Crystals teach how baseness can be turned into beauty, how something very precious can be made out of things that are very common. Diamonds can be made out of coal dust, and thus black baseness is turned into bright beauty. The common clay that seems so base makes mud, and it makes bricks, but it also makes sapphires and rubies. A certain man was very humble and he was esteemed very base. Men spat upon him, but God chose him and gave him a name above every name, and made him "chiefest among ten thousand

and altogether lovely." And God can do a similar work for us, even as he did for a Paul, a Gough, and many another. "By the grace of God I am what I am," says the diamond, the sapphire, the flower, and the saved soul.

PERFECTION. Perfect crystals are very rare. Among the thousands of crystals that I have handled I have seen but few that could be called perfect, even approximately. But they are the ones that bring high prices. They occupy the places of honor, and they do not crowd each other. If I were a crystal I would try very hard to be perfect, even if it cost the pain of intense heat and long confinement in dark cells. I would strive to keep out impurities and to let all my elements mingle in due proportion and in symmetrical form. My reward would come when at last the light burst upon me and I was chosen to deck some royal diadem, or lie on velvet in some great museum.

A LAW WITHIN US. It is difficult to tell how crystals are made. An unseen force brings atoms and molecules together in right proportions and at certain angles. That force is the life power of the inorganic world. Some call it law; some call it a law of God, and some call it God. There is also a force, or law, working within us that shapes our thoughts and feelings into crystallized character. Some call it conscience and some call it God. The perfection of character depends upon co-operation between God's will and our will. "I will put my laws into their hearts," God says, the same God that puts his laws into the substance of the crystal.

GLORIFYING ONE'S SURROUNDINGS. There are pieces of rough rock in my collection that have no beauty or value in themselves, yet I give them places of honor because of some rare gem that grew on them, or within

one of their dingy cavities. The crystal glorifies its surroundings. Thus great and good men glorify the place of their birth. Thus Christ has glorified, not Palestine alone, but the whole round earth. Among all the heavenly worlds this world holds a place of highest honor. Thus too, on a smaller scale, we may glorify our surroundings, though now they may seem to us very commonplace and dull.

A Healing Power. I have crystals that were once broken in the earth, but Nature mended them with her own home-made cement. She even put new crystal faces on the broken ends. There is a healing power in the very rocks, as also there is in the trees and in the human body. That power seeks to make *whole* what is broken or wounded. And so in the spiritual realm there is a healing power that seeks to make *whole* and *holy* what is wounded by sin. It were indeed strange if God should provide for the healing of the crystal, the rock, the tree, the body, and make no provision for healing bruised and wounded souls. Would he mend the watch case and not the works inside? Surely there is a balm in Gilead. "He restoreth my soul."

Inclusions. Many crystals have what are called inclusions. It may be a bit of clay, or coal, or a drop of some fluid, or an empty cavity, or another crystal, perhaps a gem stone. Analogous to these things are the thoughts, feelings, beliefs, principles, likes and dislikes, that are found in our souls. Some are good and some are bad. A bubble of air caught in an irom beam may sometime cause a terrible accident. A falsehood or false principle that seems trifling now, embedded within us, may cause a great moral collapse some day when the stress of a great temptation comes on that spot. Half

of the diamond may need to be cut away to get rid of a flaw.

A Name on the Forehead. Persons who are familiar with crystals can tell at sight those that came from certain localities, because of certain slight peculiarities that mark them. The name of their home is written plainly all over them. They are more plainly branded than the cattle on the plains. This illustrates the promise of Rev. 3:12, which tells us that God's name, Christ's name and the name of the New Jerusalem are to appear plainly on our foreheads. If those names are distinct no one can have any doubt as to whose we are or where we belong.

Tried by Fire. I sometimes determine the character and name of a crystal by testing it with heat. Some crystals stand the test and some do not. Many and diverse effects follow the application of intense heat to crystals, metals and other stones. So the fiery tests of persecution and affliction give different results with different persons. The full development of this illustration would fill a book.

Electricity. Some crystals are electric, as topaz, tourmaline, garnet when polished, the diamond when unpolished, and some others. They become electric by friction or heat, by the heat of the sun, or even the warmth of the hand. And what is electricity but the Holy Spirit power of the inanimate world? And what is the Holy Spirit but the electric power of the spiritual world? I mean by this simply that in the two realms the two powers have many points of analogy. They are both silent, mysterious, quick, efficient, and partial to certain substances and conditions. They came from the same God. They are his power, latent for a long time in nature and human nature, and not even yet fully utilized

Gold and Fools' Gold. "All is not gold that glitters." Iron pyrites is, proverbially, fools' gold. Not all crystals that shine and sparkle are gem stones. Some dark, dull-looking stones take a high polish and reveal great beauty. It is well to get the opinion of experts as to the genuineness and value of what is offered as a precious stone; and it is well to avail ourselves of the experience of those older and wiser than we are as to the real value of people and projects that glitter with promised gold. Fools' gold and diamonds in the rough are more common among men than among the rocks.

Light-bearers. There are some crystals that shine, or can be made to shine, in the dark, as fluorite, and some diamonds. They are called phosphorescent, or light-bearing. It is a very interesting property as seen in some crystals, and still more interesting as seen in some persons. Paul was a wonderful light-bearer, else he could not have been "exceeding joyful in all his tribulations." The diamond must absorb light from the sun before it can shine in the dark. Unless the Light of the world shines upon us we cannot shine upon the darkness of the world.

Rotten Crystals. There are analogies of evil among crystals, as well as analogies of good. Some of them keep up a fair outward appearance while they are rotten through and through. When the collector attempts to take them out of the place where they grow they fall all to pieces. Such was the case with some magnificently appearing crystals of tourmaline at Paris, Maine. They were like the oak with a rotten heart, like the garment eaten through with moths, like the ship with a worm-eaten hulk, and like the person who keeps up a good outward appearance while his soul is rotten with sin. A

slight touch of adversity or temptation sends him all to pieces morally, a sad wreck of a splendid past.

Hypocritical Crystals. Pseudomorphs, or crystals with a false form, have been called hypocrites. Being one mineral they take, perhaps by sly stealth, the crystal form of another mineral. A great many minerals have this habit. It is a sort of natural depravity, or original sin, among crystals. Inwardly such crystal hypocrites are one thing; in outward form they are another thing. Where to place them depends on whether you classify them by substance or by form; by what they really are or by what they profess to be. That there are plenty of pseudomorphs among men we all know, sometimes to our sorrow.

A Brighter Lesson. But after all I prize my pseudomorphs, for they teach me brighter lessons than the one just mentioned. One such lesson is that we can change the mammon of unrighteousness, sordid riches and filthy lucre, into enduring friends that shall welcome us to everlasting habitations. How? Simply by doing good with it, thus changing its perishable elements into imperishable love. Thus also common duties, every day drudgery, and fiery trials, can be turned into pure gold and into diamonds of the first water.

They also teach me that, even as the divine Christ took upon himself the form of humanity, and because he did it, so I, by reflecting as a mirror the glory of the Lord, (2 Cor. 3; 18 R. V.) may be changed into the same image from glory to glory. "As we have borne the image of the earthy, we shall also bear the image of the heavenly."

Some pseudomorphs are formed by dropping out one element and absorbing another. It is said that iron tools have been changed to copper by leaving them in the

water in a copper mine. We can conceive that thus iron might be changed to gold if left long enough in the waters of a rich gold mine. Love in place of selfishness, and Christ in place of the world, will change any soul into the divine image.

I have some crystals that were only partially changed, changed in the center but not outwardly, or changed outwardly but not in the center, when I plucked them out of their clayey or rocky home. As they were when I found them so they remain. No further change is wrought in the dry air of my mineral drawers.

A Spiritual Body. Some crystals are largely made up of some coarse material that is easily seen, while running all through them are fine threads or scales of another substance that is not easily seen. Dissolve out the coarser part by some chemical process and you have left a far lighter and more delicate crystal of the same form. And this illustrates that view, whether true or false, in which some people find great comfort, of the spiritual body as being now within us but to be set free at death from the flesh and blood body.

A Temperance Lesson. By chemical analysis a great many different substances are found in crystals, but no alcohol is ever found in them. Drops of fluid are found imprisoned within some of them, but never a drop of alcohol. We find in nature crystals of salt, of water, of iron, and of many other useful substances, but nature utterly refuses to make crystals out of so dangerous a thing as alcohol. The crystal world is a temperance world, with plenty of water but no intoxicants.

Opaque and Clear. Some crystals are cloudy or opaque from one end to the other. Some are clear at the starting point but grow opaque towards the end. Some are imperfect and opaque almost to the end and

then they begin to improve. There is quite a tendency among crystals to reform at the end. Some are clear from beginning to end. And all these varieties of crystals find their counterparts among men, both as to the whole trend of life's journey, and also as to their good resolutions on New Year's Day and the way in which they are kept or broken.

The Color of All Colors. Crystals, as well as flowers, are found in all colors and in all shades of color. They differ from each other wonderfully in this respect. But all their colors come from the pure white ray of light in the sunbeam. And this illustrates the truth that all the Christian graces, so many, so varied, and so wondrously combined, come from the pure white ray of love that falls ceaselessly upon mankind from the sun of righteousness. Our hearts, like the glass prism, are to catch that ray and separate it into its colors. The ray of light reveals to us the nature of the sun; the ray of love reveals to us God's nature.

Snow Crystals. Water is a mineral as truly as quartz or gold, only it melts at a much lower temperature. There is no end to the variety of its crystalline forms as seen in the snowflakes. A thousand or more have been described. And there is no end to the beautiful lessons to be learned from water and snow. The snow crystals are very frail, but when united in great masses they have resistless power. Being formed in the sky they are far more perfect than crystals formed in clayey soil or rocky cells. And so our souls will take more perfect shape in heaven than they do here on earth.

Sometimes the still air is full of tiny frost crystals, all resting at about the same angle By reflecting or refracting the sun's rays they form the beautiful halo which we sometimes see around the sun. And is there

not a sense in which the halos of glory about the head of the Son of Man will be formed by the light reflected from the great multitude of the saved? Thus are formed the halos of glory which, more and more as the centuries go by, surround the name and fame here on the earth of the one perfect Man.

Yes, truly there are sermons in stones, and I have hinted at only a few of them.

CHAPTER XIV.

Crystals and Flowers*

Comparisons may be odious, yet they are inevitable, and sometimes they are interesting and instructive. I love flowers in a general way, but crystals are my hobby. My wife cultivates flowers and I collect crystals; so we cannot help comparing them at times. It is the object of this chapter to compare the two impartially, with a slight leaning, however, in favor of crystals.

The number of people interested in flowers is vastly larger than the number of those interested in crystals. This is because flowers are much more numerous and wide spread than crystals, and because they can be grown and their growth watched day by day. If we could search the globe through and through we might find that the crystals outnumber the flowers as much as the cubic miles in the earth outnumber its surface miles. But the crystals of any size that can be found on or near the earth's surface are much fewer in number and variety than the flowers. Dana describes about one thousand minerals, not all of which occur in crystals. Botanists have described over one hundred thousand varieties of plants,

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nearly all of which have some kind of flower. During thirteen years spent in Colorado I found less than fifty varieties of minerals, and rarely, if ever, more than six or eight in one locality. Yet often, in some mountain park or glen, I have been able to pick a score of different kinds of flowers on a few square rods of ground at one time. The number could have been largely increased if I had remained on that spot all summer. I took a walk early one morning, going nearly a mile from our camp, and in that walk I picked about fifty-five kinds of flowers. Others have done better than that even. In the Rocky Mountains—the very home of crystals—from two to four thousand varieties of plants have been found. Flowers, moreover, are found, or can be made to grow, wherever human beings live, and in some places where they cannot live. They grow in ocean water and on snow-clad summits. I have seen them growing out of the edge of snowbanks, and above timber line I have trod on dense masses of color, on flower beds of wondrous beauty and variety.

Crystals are found only in certain localities. In many thickly settled regions the people hardly know what crystals are, except as they chance to read about them, or see them in some museum.

Moreover, flowers possess the wonderful power of reproducing themselves, and of bringing forth thirty, sixty or an hundred fold, or more even than that. Crystals have no such power; and yet mineral substances possess a power equally wonderful, the inherent power of crystallization; and he who understands how to do it can make very beautiful artificial crystals out of various substances.

Flowers occur in such profusion that they can be massed in bouquets, and thus used to beautify our homes

and churches. The poorest people can thus use them. The same thing can be done with crystals if you have enough of them. Only kings and millionaires can make precious stones into bouquets for necklaces and crowns. I saw one day a large glass case full of most magnificent crystals and clusters of crystals of all sizes and of richest colors. It was a wonderful display of stone flowers; but it was worth a great many thousand dollars.

But what crystals lack in number they make up in durability. Flowers wither and fade, some in an hour, some in a day, all in their season. This is necessary in order that they may perfect seed and produce other flowers. But crystals are, most of them, lasting. They abide as things of beauty and as joys forever. I have crystals that have been handled and admired for nearly half a century, yea, I have a carnelian whose color is as bright as when it was polished before Christ was born. It is a century flower in that it lasts for centuries and is always in blossom. On the day that I wrote these lines I picked up from the gravel in the street a blood-red carnelian which, if it is not lost, will outlast and outblossom myriads of red flowers. My crystals are always in blossom. They are earth's true everlasting flowers.

Nearly all flowers are symmetrical and perfect and pure, while vast numbers of crystals are distorted, imperfect and mixed with impurities. This is because crystals grow underground and often in cramped cavities where many chemical substances meet. This fact gives more opportunity for the exercise of judgment and taste in collecting and selecting crystals. Perfection, or a fair approach to it, adds wonderfully to the value of crystals. They are far more subject than flowers are to the classification of good, better, best; poor, poorer, poorest. All honor—the honor of high prices—to the crystals that are

formed pure and clear and symmetrical in the dark, damp ground. The wonder is that any of them ever approach perfection.

Crystals grow *in* the earth, while flowers grow *out* of the earth, out of it in a double sense. If crystals and crystalline rocks had not crumbled and decayed and thus formed the soil there would be no flowers. Flowers are crystals appearing in a new form, in a more spiritual body. Flowers are resurrected crystals. And will not all the decayed crystals in the soil of the earth be resurrected sooner or later? I would go far to see the flowers that grew from soil made by grinding my drawer of gems to finest dust. Doubtless the coloring tint of many a flower comes from the color of some decayed crystal. Certain mineral substances mixed in the soil deepen the color of flowers and add to their beauty.

Flowers owe their bodily substance and their coloring matter mainly to the soil; but they owe their spirituality, if I may so express it, to the sunlight. But the spectroscope tells us that the sunlight comes from minerals in a state of vapor. The substances of which the crystals are made, etherealized a million fold, send their intensely spiritualized waves to act upon coarse mineral soil millions of miles away; and the result is—*nothing*, unless God puts between them the mysterious thing that we call vegetable life; and then it is the plant, the flower, the fruit, the seed. Oh, how wonderful are the inter-relations of God's works, and hence the inter-relations of the sciences!

"Let me hold you just so far away," says the sun to the earth, "while I breathe upon you perpetually the etherealized essences that shall cause your rocks to bloom and cover you with robes of beauty." Flowers are the myriad fireworks of the earth, that are slowly exploded

by the heat of the sun. Every plant and tree is a vegetable volcano, that lifts transformed dirt and rock and fire into the air.

Sometimes when my wife is watering her plants to keep them alive, or laboriously carrying them into the house to keep them from freezing, I remind her of the superiority of my crystals, inasmuch as they need no water and are indifferent to cold and heat. Yet that statement needs to be qualified. When first found some crystals are very dirty and need much water to cleanse them. And if the dust is allowed to settle on them, they have to be cleansed anew. I have some porous minerals which, if dipped in water for an instant, and then put to the ear, give out a curious sound as though every pore was greedily sucking in moisture. Water greatly improves the color of some crystals, so much so that I keep them in vials of water

Moreover some of my crystals have drops of liquid inside of them.. If left out on a very cold night the liquid would freeze and, in expanding, would shatter the crystal. I heard of one man who thus lost many valuable crystals by leaving them outdoors on a very cold night. But such crystals are only a very small part of any collection.

The lover of flowers can claim a greater number of species; but the lover of crystals can, I think, claim a greater variety in the individuals of a species. Flowers of the same kind are generally alike. One answers as well as a hundred unless you wish to mass them. Crystals of the same mineral, however, are very unlike. They not only differ in color, as sweet peas do, but in many other respects. Each locality has its marked features, different from those of other localities. And in each locality each individual crystal differs from all the

rest in the same locality. I have a large number of quartz crystals from the Crystal Beds of Pikes' Peak, and each one has some peculiarity of its own, besides those common peculiarities which they all have and which distinguish them from quartz crystals of all other localities. My drawer of quartz crystals has a variety to it that a drawer full of daisies, or even of sweet peas, would utterly lack, unless it were in the one matter of color. Calcite is found crystallized in hundreds of different forms, all modifications of the hexagonal system. In crystals of almost any species there is an endless variety of form, size, color, luster, transparency, etc. My wife has a few variations among her geraniums; but I have ever so many variations among my calcites, feldspars, topazes, tourmalines, pyrites, zeolites, fluorites, quartzes, etc. If I want variety in nature I will go to my cabinet of minerals rather than to my flower garden.

Flowers are constructed largely with curved lines and surfaces, while crystals, as a rule, are a combination of straight lines and plane surfaces. Flowers are superficial, in the sense that they have no solidity. Crystals are pure, solid geometry. The mere external form of flowers may be more pleasing to the eye than the form of crystals. Probably this is one reason why more poetry, vastly more, has been written about flowers than about crystals, though the principal reason is because they are more common. The poetry of flowers is on their surface; that of crystals is within, and harder to get at.

There are two ways of looking at single flowers or crystals, or at groups of either on the same stalk or specimen. One way is to look at them in their entirety, as they are held at some little distance from the eye. The other way is to hold them close to the eye, using a mag-

nifying glass and examining their separate parts and minute peculiarities. It is the difference between looking down on a city from a high tower, and looking at it building by building as you walk through it. Yet, strange to say, comparatively few lovers of flowers and crystals ever look at them in this latter way. Hence they miss many of their beauties and peculiarities. I would as soon think of studying the stars without a telescope as of studying flowers and crystals without a magnifying glass. What one sees with the naked eye is only the head-lines of Nature's newspapers, only the chapter titles of her marvelous book. I have sometimes made my eyes ache by using the glass too much, and yet I am sure that my drawer of crystal gems is good for sore eyes.

When autumn comes and the flowers have disappeared from the fields, then the crystals take possession of the earth and cover it with a mantle of white to hide the ugliness of its dried weeds and flowerless plants. They are not the crystals that are dug out of the earth, but those that fall out of the sky. They come in unnumbered myriads; and if we are permitted to include them in our count, the crystals, even on the surface of the earth, vastly outnumber the flowers. They are all on one plan, the hexagonal, but in infinite variety. Every snowstorm has its peculiar crystals, owing to the changing states of the atmosphere in temperature, humidity, electricity, etc. I cannot preserve these crystals in my collection, except in picture form, and I have pictures of several hundred different forms that have been described. The scientist tells us that the snow crystals are made up of minute crystals in which are found all the colors of the rainbow, and those colors unite to form the purest white.

I am reminded, however, that these crystals are

evanescent; they are apt to fade quickly, sometimes as soon as they strike the earth. Yes, but wherefore? In order that they may water the earth and cause it to bring forth flowers, flowers whose wondrous colors come partly from mineral substances, partly from the sun's rays, and partly, perhaps, from the snow flake's hidden tints.

Water, the very water with which my wife waters her flowers, is a mineral, the most beautiful and useful of all minerals. Without it there would bloom no flowers on the earth, and without it that consummate, many-hued flower of the sky, the rainbow, would not exist or be seen. Flowers reveal to us the inner spiritual qualities of the earth, but those minerals out of which transparent prisms are made tell us strange stories about the motions and chemical composition of our sun and of the far more distant stars.

When the thermometer is below zero and flowers cannot bloom out of doors, the fairy who presides over the crystal world covers our window panes with beautiful frost crystals; and then, though we cannot look through the glass to see the glory of God in the green fields and starry skies, we can look and see his glory nearer by in the delicate tracings and pictures which the great Artist draws for us on the glass.

In some of her rarest moods of prodigality the crystal fairy seeks to eclipse the glory of summer fields and blooming orchards by covering the bare ground, the dry grass, and even the leafless trees with untold myriads of crystal flowers. The sun shines on then and the whole world around us becomes an Aladdin's Cave. "What can your summer fairies do compared with this," she boastingly cries. I close my eyes to recall the summer fields for comparison. I open them, and, presto! the fair

vision has vanished. I would better have kept my eyes open and ignored comparisons. I wonder if, in the cooling stages of the earth, when the atmospere was charged with the vapors of mineral substances, there were not times when all the earth sparkled with myriads of crystals of quartz, or calcite, or topaz, or sapphire, crystals which a hotter temperature would soon dissipate. It is a beautiful fancy, and we can transfer it to our sun and to other suns and worlds as they cool off. I mean to be on the lookout for such things in some of my future excursions through the universe.

When hard pressed by my wife for arguments in favor of crystals as against flowers, I sometimes quote scripture. I tell her that John used twelve kinds of crystals to give us an idea of the beauties of the New Jerusalem, while he said nothing about flowers. "Yes," she replies, "but who was it that told us to consider the lilies but said nothing about crystals? And, besides, how could the tree of life of which John tells us, bear twelve kinds, or crops, of fruit, one every month, if it were not frequently or constantly covered with flowers?" It would be quibbling for me to reply that it could not do so if it were not for the crystalline water flowing at its roots; and so I let her have the last word. I find that the best way. My last word, however, about crystals and flowers is, that if I find either of them missing from heaven when I get there I shall be greatly disappointed.

CHAPTER XV.

Crystals and Birds

Much has been written about birds in the last twenty five years. Certain writers have gained a well-earned reputation as interpreters of bird life. Though the birds are well able to speak for themselves, yet many poets and prose writers are ready to speak for them. The song of the bird is heard in the field, and there is no speech or language, no paper or magazine, where it is not also heard. The bird is very much in evidence in modern literature.

Crystals are deaf and dumb. They cannot speak for themselves, and why should not some of their friends speak for them? It may be a hopeless task to try to prove them as worthy of admiration as the birds, but possibly I may be able to show that they have some of the qualities that make birds so popular.

Crystals appeal to our sense of beauty chiefly through their form and color. Birds, many of them, have beautiful forms and colors, and they also have the tremendous advantage of being alive. Life and live things are intensely interesting to people. At the World's Fair there were crowds of all sorts of people around the

tanks that contained live fish, while the stuffed fish were dry, dry in a double sense, and devoid of interest, save to a few ichthyologists. Even the stuffed birds were vastly more interesting when mounted in life like attitudes. When our party stood on the brink of Yellowstone Canon they seemed far more interested in the occupants of the eagles' nests on the crags below them than they were in that wonderful gorge.

If one studies crystals closely he sees in them a sort of life, though it differs much from the self-conscious life of animals. The lover of crystals does not like to hear people speak of "dead matter." There is a law, or a force, either intelligent or guided by intelligence, which is constantly at work among the molecules and atoms. When the circumstances are favorable that force builds crystals of wondrous form and beauty, as under other circumstances it builds birds and flowers.

An Artist, an Architect, a Mathematician, a Chemist and a Lapidary work together in harmony as one person, to produce the result. They *are* One. The marks of intelligent design are visible in crystals, as well as in birds and in flowers. One has to look closer for them however, just as crystals themselves are harder to find than birds and flowers. They are not so obtrusive. Perhaps they are reserved for a more select class of admirers! The editors, who have in mind the tastes of the great reading public, will accept an article on birds much more readily than one of equal merit on crystals.

Birds are admired partly because they are so bright and beautiful. They flash all the colors of the spectrum through the air and among the foliage. It is as though the rainbow were cut into a thousand fragments, and each fragment were alive and darting hither and thither

around us. But many of the crystals are also very bright and very beautiful. Royalty, wealth and beauty have always paid the tribute of high prices and profuse display to those crystals, which, uniting the three qualities of beauty, rarity and hardness, are called precious stones. Such crystals receive the compliment of being imitated and counterfeited.

CRYSTAL BACKGROUNDS. Green fields and blue skies form the background against which birds are usually seen, though the birds themselves do not disdain to feed on earth worms and other earthy things. But the background of crystals, their home and environment until rescued by man, is dirt, mud, sand, clay, coarse rock and dark caverns. They are bright and beautiful under "creditable circumstances," as Mark Tapley would say. They glorify their surroundings. They teach us that beauty can come out of baseness and brightness out of dark surroundings, sapphires out of clay and diamonds out of coal dust—even as birds have been evolved from reptiles. They show the possibilities of mud and rock. Crystals are rock flowers; they are minute stony stars; they are underground birds. There is no kind of beauty above ground of which they are not mute underground prophecies.

SPEAKING CRYSTALS. But the birds sing! Yes, and let it be frankly confessed that therein they have a great advantage over crystals and flowers. A June morning bird concert is one of the most wonderful things in the world. To the appreciative ear it is what starry skies and flowery fields are to the eye. It declares God's glory. It is the milky way of sound, encircling the earth every day.

Crystals cannot speak for themselves. They are

dumb, and yet not wholly so. The gems, like the flowers, speak a figurative language, artificial and arbitrary in part, yet not entirely so. Some of the crystalline stalactites that hang from the roofs of caves give forth beautiful sounds when gently struck. In some places regular tunes can be played upon them, as upon the "Organ" in the Grand Caverns at Manitou. The singing sands that are found in some places on the sea shore are composed in part of pulverized crystals.

On the whole, and in a baldly literal sense, we must admit that the crystals are dumb to mortal ears, and so are the stars. Yet it is true of the crystals, as well as of the stars, that—

> "In reason's ear they all rejoice,
> And utter forth a glorious voice,
> Forever singing as they shine:
> The hand that made us is divine."

Eggs. Then there are the birds' eggs, the study of which is a science by itself. What a charm there is in their varied shapes and colors, what potency of life, what strange possibilities! They do not however possess such variety of form and color as crystals do, and how much more easily they are crushed by careless hands and untoward accidents! I have found carnelians that were exactly the shape of eggs, but of course they were not crystals. Eggs are bounded by countless curves of beauty, while crystals are constructed out of straight lines, plane surfaces and solid angles. The oolitic sand found on the shores of the Great Salt Lake, and the oolitic marble of Iowa, are so named from the resemblance which their grains bear to eggs.

Who can locate the starting point of life in an egg?

And who can identify the central molecule around which the crystal is slowly built up? The crystal cannot reproduce its own kind, though it often bears many little crystals on its sides, but it can crumble and form dirt. Flowers grow out of the dirt. Worms and insects feed on flowers, and worms and insects and seeds are food for birds. Thus they are all related and inter-related, first, second, or sixteenth cousins.

Nests. The birds have nests, coarse or fine, large or small, high or low. They are found in many out of the way places. The crystals have nests also. The term nest is of frequent use among crystal hunters. It means a cavity in which a number of crystals are found. Dame Nature made the nest and put the crystals there, and she fussed over them with no cackling nonsense.

Once in the mountains I found a nest of crystals under the roots of a pine tree. It contained scores of smoky quartz crystals. In another place I found a nest of beautiful green Amazon stone crystals. I ruthlessly broke up both of those nests and took all the eggs. I had no qualms of conscience in so doing. They were made to be broken up. The crystals had been there for ages but they had not spoiled. They were ripening all the time. Some of them had been broken by some earth jar, but nature had fastened the pieces firmly together. Nature likes to mend what she herself mars, but not always what man mars.

In some nests crystals are slowly growing now. It may be ages before the nest is discovered, or possibly some miner's pick may break into it tomorrow. Only the other day I dug with my pick into a shaly rock and unearthed a number of geodes that were just about the ize of the nests of small birds. When I broke them

open I found them full of sky-blue eggs which nature had deposited there very slowly in the dark.

In Winter Time. The birds go away in winter. Most of them are only summer visitors. But our drawers of crystals remain and we can look at them whenever we will, and with a good conscience, for we do them no wrong in caging them, as we do in caging birds. And then more crystals come, the perfect ones that fall out of the sky. They come in untold millions. They come through the air silently, with bird like motion, and they light on all the places where the birds were wont to light. They cover the earth with the white purity of the skies. They are very much in evidence. They make white spots that can be seen from neighboring planets, if their inhabitants have eyes and telescopes like ours; while all the bird songs of earth united in one could not begin to reach their ears. These crystals drive the birds away, except the few that seem to revel in snow flowers. They drive the flowers away also and take possession of earth and sky. They cannot drive away the stars, but they can imitate and reflect them. They cover the earth with powdered star light by night, and with opaque sunshine by day. They give mother earth a white satin robe that is sprinkled with diamonds.

Amiability. The birds are not always at peace among themselves. Their disposition does not always correspond to their plumage, nor their manners to their songs. We would not slander the pretty things, but it is an open secret that some of them are great scolds, and that they often quarrel and fight among themselves, and even butcher and kill one another. One kind is so cruel and murderous that he is called the butcher bird. The crystals are not so naughty. Whatever they may have done in the dark in their old homes they dwell together

in my drawers in perfect peace. Even the fluorite crystals, which contain a substance that is a perfect demon when set free, dwell peacefully with the rest, holding the demon within them in perfect subjection. If he should get loose he would attack the innocent quartz crystals with the utmost ferocity and destroy them utterly.

The birds fly away, and they die too, as do the flowers, but the crystals remain. They will outlive me and my children. They are petrified bird plumage and frozen bird music. They are solid, substantial and staying. They do not shrink, or wither, or fade, or rot, or die.

I do not suppose that I have proved the crystals superior to the birds in all respects. I am satisfied if I have showed that they are not altogether inferior to the birds, and that they are worthy of a share in our admiration and love.

CHAPTER XVI.

Crystal Rhymes.

This book leaves untouched the experiences of the author along all lines—preacher, teacher, etc.,—except those of an amateur collector and lover of minerals. It contains an honest record of his experiences as such. It would not be complete if it did not contain a record of his rhyming effusions about crystals, and hence those effusions are here reluctantly inserted. They are called rhymes, not poems. There is a fine field here for the poet, but to do it justice he must love crystals and know something about them. I hope such a poet mineralogist will sometime be born; he can hardly be made. There certainly is poetry in the crystals, if only it could be written. This thought is partly expressed in the last poem—no, rhyme—*an Uncut Gem*.

Rhodocrosite.

As red as the crimson tides
  That through our arteries flow,
As red as the fiery clouds
  That o'er the volcanoes glow,

As red as the rosiest cheeks
Of healthiest lads and misses,
As red as the reddest rose
That gladly the cool wind kisses,

This manganese carbonate,
This gem rhodocrosite rare,
That grew in the Rocky Mountains,
Is beautiful beyond compare.

By light of the evening lamp
More crimson by far it seems,
Than when in the light of day
It modestly glows and gleams.

Like Iceland's transparent spar
In crystals of pure calcite,
This crystal doth doubly refract
The rays of transmitted light.

And all of my other gems,
Of every hue and shade,
By side of this crimson gem
Seem ever to pale and fade.

The Aqua-marine.

I hold in my hand a gem
Whose color is of the hue
Of fathomless depths of ocean,
A mingling of green and blue.

From crest of a snow-clad mountain,
Antero of range Sawatch,
Whose line of uplifted peaks
America scarce can match,

From cliffs that are lifted far
Above the dark timber line,
Where tempests of rain and snow
With lightning and wind combine,

'Twas brought by a miner brave,
Who seeks for rare gems and gold
In places where foes are fierce,
The storm-king, wild beasts and the cold.

Since both bear the name of beryl
'Tis kin to the emerald green,
And both among royal gems
In diadems fair are seen.

'Twas ages upon ages ago,
When near was the ocean strand,
The fairy who makes the crystals
Did wave o'er the rocks her wand.

And when so exactly and swift
Together the molecules flocked,
A color she sought before
The atoms together were locked,

A color unique and rare,
Alone for that gem prepared,
In which the best tints of heaven
With best of the earth are shared.

She looked to the briny deep,
And caught from its liquid store
A hue that surpassed in beauty
The hue of the golden ore,

A hue that the waves had gathered
By joining in purest love
The green of the emerald fields
To the blue of the heavens above.

And deftly she used that hue
To color the aqua-marine,
In which the rich hues of ocean,
Of earth and of sky are seen.

And though the blue sky may fade,
And earth be bereft of green,
The sea be no more, yet for aye
Their hues in this gem are seen.

And ever it speaks to me—
This gem from the snow-crowned crest—
Of the mountains so high and grand
O'erlooking my home in the west.

It speaks of the ocean wave
That rises to kiss the sky;
It mirrors the green of earth
And tells of the home on high.

Sermons in Stones.

It came from the Empire state—
This crystal of quartz so bright—
It came from the Mohawk land,
From mountain of hard quartzite.

'Tis clear as the clearest crystal,
As pure as a drop of dew,
As bright as the gems that John
Beheld in Jerusalem new.

No angles more evenly cut
By lapidist's skill could be,
And smoother by far its planes
Than surface of glassy sea.

Though growing in caves of gloom,
Where rays of the sun came never,
'Twas made for the sun, as we
Were made to love God forever.

This acid of silica pure,
Stone ice, 'krustallos' of old,
Is worth beyond its weight
In nugget of purest gold.

For out of its liquid depths,
Like clouds from a cloudless sky,
Full many a sermon rises
As I gaze with steadfast eye.

The sermons that bard of old
Declared in the stones were found,
Have risen by scores from out
This crystal that makes no sound.

'Tis full of the thoughts of Him
Whose glory all things reveal—
The crystals as well as the stars—
On which he has set his seal.

And so it is worth to me
Far more than its weight in gold:
The truths that I find in it
Can neither be bought nor sold.

No crystal in all my store
Is dearer than this to me,
For down in its lovely depths
A vision of heaven I see.

And when I have sought to feed
The lambs of the Master's flock,
The manna of heaven I find
Within this crystal rock.

And out of transparent depths
The water of life flows free:
It flows from the Word of God
By way of his works to me.

O'er many a truth divine
Its crystalline light is shed,
As oft as the Word of God
In light of his works is read.

The Crystal Beds.

In rear of a famous peak
Erst named for a soldier brave,
In region obscure and wild,
Which Titans with rocks did pave,

Well guarded by giant cliffs,
And hid in dark thickets of pine,
Extending o'er acres wide,
There lieth a crystal mine.

There once, with intensest power,
The chemical forces strong
Did fashion the lovely gems
That nature has hid so long.

Dark prisms of quartz, from which
The gems of the cairngorm stone
Are cut into brilliant forms,
Whose beauty is all their own;

And crystals of true topaz,
In colors of green and white,
That rival the diamond's power
To scatter the rays of light;

And clusters of Amazon stone,
As green as the aspen leaf,
With albite and microcline,
As white as the ripened sheaf;

And crystals of green fluorite,
Like those from the British land,
Whose acid has power to eat
All wares that are made from sand;

And gothite, an ore of iron,
Whose blades of metallic luster
Add beauty, as well as strength,
To metal of warlike muster;

And 'mongst the rough old granite
And ledges of hard quartzite,
That rarest of gems is found—
Deceiving yet plain phenacite,

A gem that is found on earth
In places at most but seven,
And always 'tis found far up
On heights that are near to heaven.

In quantities large or small,
In rocks that are crystalline,
These manifold forms of beauty
Are found in that crystal mine.

An Uncut Gem.

My thought is a gem—of that I am sure—
A gem in the rough, yet wondrously pure,
A gem of first water, flawless and sound,
As clear and as bright as ever was found.

The joy of my soul in pain of its birth
Has proved it to me a gem of great worth,
But now how to cut, how polish and set
My gem in the rough is puzzling me yet,

To bring out its beauty, color and light,
And cause it to shine like stars in the night,
To flash and to burn, and crowned to be
Like tropical isle in midst of the sea,

To live and be prized by old and by young,
And, set to rare music, by millions be sung,
Enshrined in the hearts of good men and pure,
And destined forever and aye to endure,

To live and survive the wreck of old earth,
And date from my day the time of its birth,
To take its true place mid thought's golden store,
And oft be repeated when I am no more.

I hold the rare thought all safe in my heart,
But have not the skill and know not the art
To shape it aright, with untrained hand
And only the simplest words at command.

O poet! please take my thought so divine
And put it in form that men shall call thine;
The joy and reward sufficient for me,
My child clothed in beauty forever to see.

CHAPTER XVII.

A Crystal Yarn.

In order to make this book a complete record of my experiences as a crystal collector I inserted in the last chapter some crystal rhymes. For the same reason I insert this chapter of crystal fiction. The story is fiction, but it gives a true view of the way in which a collector's imagination sometimes works. Every person, I suppose, has his day dreams of success along the lines of his business, his profession, or his hobby. This is one of my day dreams, and it came about as follows:

I had desired very much to find a rich crystal locality which I should be the first to exploit, and which, for a time at least, should be exclusively my own. For some reason I fancied that perhaps I could find such a locality in a very wild and partly unexplored locality in the mountains known as Lost Park. I decided to spend a two weeks vacation there one August, hunting for crystals. I prepared myself accordingly and left Denver one pleasant morning on a train that would take me up a Colorado canon to within some twenty-five or thirty miles of the region I had in mind.

As I settled myself in my seat after the conductor had taken my ticket my thoughts flew ahead of me to the

station at B., from which a slow and uncomfortable stage took me some dozen miles to a small summer resort at the foot of a high range that rose far above the foot hills and canons through which I had come. On making inquiry I learned that eight miles up a certain creek, and over a very poor rocky trail, there was a miner whose name no one knew except that he was called Solitary Bill. They said that he was working a claim and living all alone in a log cabin. Leaving the heaviest part of my outfit to be sent on when called for I pushed on that night to the miner's cabin, after getting careful directions as to its exact location. My walk took me through some of the wildest scenery in the mountains. The boulders and rock masses were tremendous in size.

I reached the cabin just as the miner came down from his mine, which was a mile distant up on a wooded mountain. I frankly told him who I was and how I wanted to spend my vacation. He had heard of me through a cousin who was one of my parishioners. He gave me a cordial welcome and told me to make myself perfectly at home in his log cabin and with his plain fare, which I proceeded to do. He said that he was going down to the resort the next afternoon and would bring up my grip, together with some supplies that he needed. I thought that secretly he was very glad to have some company. As we sat around the fire place that night—for the altitude was 8500 feet or more, and a fire was needed every night—he confided to me that he was hoping that his mine would pan out well, for if it did he could marry the girl of his choice the next spring. "And if I do," he said, "we will go down to Denver and have you marry us." I replied that I would gladly perform the ceremony, and make a good job of it, with a fine certificate thrown in, all free gratis as a return for his hospitality.

He told me that he had been in Lost Park, a few miles away but an awful hard place to reach and a terribly wild region when reached. "I found no good prospects there," he said, "but I picked up a few crystals. Here they are," and he reached me a cigar box partly filled with crystals and pieces of ore. I detected at once a topaz and a beryl, and I carelessly asked him where he found them. "O, at the foot of a big cliff over to the southwest six or eight miles. It would take you all day to get there." I did not tell him of my many big climbs and tramps in the mountains, and I asked him no further questions.

The next morning after breakfast he gave me careful directions about the topography of the country and incidentally he told me where the cliff was that he had mentioned the night before. Then he started for his mine. Taking a lunch, a canteen, my pick and hammer combined, which I used as a help in walking and climbing and which I could use as a weapon if necessary, and taking also an old sack and some old newspapers, I struck off southwest into the wild tangle of streams and canons, of forests and rocks.

I followed a very blind trail up the creek for about four miles to where the creek divided. With great difficulty I followed the northwest branch about three miles further, which took me about three hours, so rough was the way. I kept as near the creek as I could. Often it was lost under a great jumble of rocks and I could hear it flowing under them fifty feet below me. I branched off again, after filling my canteen, and followed a dry creek bed for more than a mile. I was searching for the rocky cliff or ledge where the miner found those crystals. It had a certain peculiarity which he had described in one

word, and which I recognized a long time before I reached it.

When I reached its base it was noon; I was very tired and hungry and I ate my lunch. Then I began to search in the gravel and dry creek bed. I soon found two or three poor topaz crystals and a beryl, but nowhere in or on the ledge could I find any trace of those crystals. I then noticed that all the gravel and stones in which I had found the crystals had evidently been washed there from up the creek bed in flood time. I went on to another ledge a quarter of a mile above, over the center of which was a dry water course. At its base I found two or three small crystals somewhat bruised. I climbed to the top of the ledge and followed that water-course up to and upon another ridge of rock, and then to still another, finding a few small crystals and fragments. I knew I was on the right trail and I pushed eagerly onward and upward.

When I reached the top of the last ledge I found a shallow depression on the rock from which the water, instead of pouring over the top of the ledge in flood time, escaped through many small cavities and crevices. This explained why I had found only small crystals below.

I took a few steps forward and— Shades of all the gems ever found! Was I looking at the ghosts of crystals? Could I believe my eyes? Had I gone crazy? Was I dreaming after a day of crystal digging? Over a few square rods of rock and gravel there were spread out before me hundreds of fine crystals, large and small, and of different colors. Just then the sun shone upon them from behind a cloud, and how they sparkled! I gave one loud shout: "Eureka! Eureka!" and then I stooped and picked up a few crystals. I very soon identified topaz, beryl, phenacite and tourmaline, four of my favor-

ite minerals, and they were all of gem quality. I afterwards found other interesting minerals in the deposit. It was one of nature's few rare laboratories where she had compounded many substances, like Paris in Maine, the Crystal Beds in Colorado, and Magnet Cove in Arkansas.

Where should I begin and what should I do? I determined to make sure at once of the best crystals, and then decide on my future plan of operations as I was returning to the cabin. Under a tree close by I gathered in a heap about three hundred of the largest and finest crystals I could find on the surface. The topazes were of a beautiful blue color, like those from Siberia, very clear as a rule, with smooth planes and fine terminations, many of them doubly terminated. They were ideal. One big one was in every way a stunner. Only one end was above the ground when I saw it. As I pulled it out I saw that it was about twelve inches long and three inches thick. It was very clear through its whole length and finely terminated. I had never heard or read of a finer topaz, and from what I knew of values I concluded that the Czar of Russia, or the British Museum, or Tiffany, would be glad to pay from five to ten thousand dollars for it. There was an aqua-marine beryl, not so large, but just as fine in other respects, that I knew was worth fully as much as the big topaz, if not more. The phenacites were of less value as gem stones, but as specimens they were the best I had ever seen, especially those deposited in large, clear, rhomb like crystals on some partly decomposed beryls. They far exceeded those that I had seen and owned from Mt. Antero. The tourmalines were fully equal in quality to the best ones once found at Paris, Maine, and some of them were much larger. They were of different colors, red, green, white, blue, even some single crystals being of different colors in different parts.

As I surveyed the pile of crystals I realized that I was a rich man if I could manage the thing aright. What I had already gathered would bring me at least $50,000 in the crystal and gem markets of the United States and Europe. I gathered all the remaining good ones that were on the surface and looked around for a good place to cache them until I could come again, though I had little fear of anybody else finding the place. I felt confident that no human being but myself had ever seen that spot. I saw a large rock a few rods away and went to see if I could dig a hole behind it for burying the crystals. As I went behind it I had another great surprise. There, stretched on the ground, was the skeleton of a man, shrunken and dried and clothed in a decayed corduroy suit. Each bony hand grasped a crystal that was as fine as any that I had found except my largest and best one. The pockets bulged out with crystals, and there was a pile of them by his side. He had evidently been there two or three years; it was difficult to guess how long for in that dry climate dead bodies are more apt to desiccate than to decay. In his vest pocket I found a piece of paper containing a list headed: Mineral Debts. It was added up and it amounted to more than $50,000. I remembered a collector who had once told me that that amount would not pay his mineral debts. There was also a small vial marked 'Poison', but its contents were untouched. There was no other clue except several large peas in another pocket. To those who do not understand how those peas could be any clue I shall offer no explanation. Evidently he was an unfortunate mineral collector who had died there after he had struck it rich. He had staked out no claim so that the locality was mine except for the crystals found on and near his body. No coroner would care to come to that spot, and I did not

care to have one come and see my claim, so I took a full description and then buried the remains.

I staked out a regular mineral claim and called it Crystal Bonanza. I cached my other crystals, and also, in a separate place, those that the dead man had gathered. I then wrapped in paper as many as I could carry with me, about seventy-five pounds, and started for the cabin. It was a terribly hard tramp with that heavy load, but my heart was light. I was not superstitious, so that the skeleton had not affected my nerves. I was more afraid of living wild beasts than of dead men, and in fact I saw two bears with their cubs, and a mountain lion, but I gave them as wide a berth as I could and they reciprocated the favor.

A little after dark I saw the light of the cabin. I left my load behind a rock a little off the trail and went in. The miner had brought up my grip and among other things a bundle of daily papers, as he was a great reader. Those papers were just what I needed for packing. I said nothing that night about my discovery except to show the few crystals that I had found at the foot of the first cliff. In indirect ways I learned his views and practices on certain moral questions. He was so positive and evidently sincere in what he said about being honest and trusty and keeping one's promises that I concluded I could trust him fully. I was still more confirmed in this opinion when he did again what he had done on the preceding night, take down a well-worn Bible, a gift from his mother, he said, read a chapter, as he said was his custom, and ask me to offer prayer.

After breakfast the next morning I said to him: "I need some help and I believe I can trust you fully. When you showed me those crystals you put me on the track of a big discovery which will bring me much money

if it is managed rightly. I want a strong, trusty helper to help me dig crystals and get them to the railroad. I will pay you five dollars a day, and if I succeed as I hope, I will give you a large bonus besides." He gladly embraced my offer and then I went out and brought in my sack of crystals. He did not know their value as I did, and I simply told him that they were worth many hundreds of dollars. We carefully packed them in a box ready for shipment. He said that two years before a man had gone into Lost Park to hunt for specimens and had not come back. He had not thought much of it, though he knew that it was difficult to get out except by way of his cabin. The man had lodged with him over night but he did not learn his name. He said he acted strangely and told strange stories about a dream that he had had of finding a lot of precious stones and paying off his debts and making his family happy again.

We went together to the locality, taking powder and blasting tools, and provisions for a stay of several days. In that time we fully exploited the locality and practically exhausted it. It took two days to take my crystals to the cabin. While I was securely packing them my helper went to the resort and engaged a few burros "to take some sacks of mineral to the railroad to send to the city to see how it would pan out," all of which was strictly true. When I left my helper at the station I paid him in full and told him to call on me in Denver when he came there and I would have more for him after I had sold my crystals.

I corresponded at once with a firm in New York City that dealt in precious stones, and with which I had previously had satisfactory dealings. They sent Mr. Kunz, their expert, on at once to examine what I had for sale and to make me an offer. I knew something of their

value and I accepted the offer which he made me of $125,000 for my share and $75,000 for those that belonged to the dead man. I corresponded with the collectors and dealers whose names were on the list I had found in his pocket, and was thus convinced that my surmise as to his identity was correct. I paid their claims in full and then with some difficulty I found his widow and children in an eastern state. I told her all the circumstances and, as self-appointed executor of his estate, I turned over to her the remaining $25,000. She was exceedingly surprised and grateful.

My own money I tried to use in various ways for doing good. I did not for a moment think of retiring from my profession to live at ease upon it. Of course I kept out for my own collection and for exchange a fine lot of crystals which I showed with great pleasure to my friends.

On Christmas day I received a call from my mountain helper, and with him was a rosy-faced, sweet-mannered mountain girl. He said his mine was turning out well and they had concluded to be married. I married them at once. He offered me a five-dollar fee. I took it and then I gave the bride a check for one thousand and five dollars, and a wedding present of a very fine aquamarine gem, beautifully cut and set in a ring. They went away very happy after getting my promise to spend my vacation with them the next summer when we would hunt for more crystals. They were just leaving my house when———

"Tickets! Tickets, I say!" cried the conductor in my ear.

"Why, I gave you my ticket", I said.

"Yes" said he, "but that was only to the last station."

"Have we passed B?" I said excitedly.

"Yes, some time ago," said he.

I had been so deep in my day-dream that I had not heard or heeded the brakeman when he called the station. So I paid to the next station, from which I could walk to the place where I was going. I had had a rich day dream that I remember with pleasure. It took me an hour and a half to dream it, and it has taken me somewhat longer to write it.

CHAPTER XVIII.

Gold.

"Gold! Gold! Gold! Gold!
Bright and yellow, hard and cold,
Molten, graven, hammered and rolled;
Heavy to get and light to hold;
Hoarded, bartered, bought and sold,
Stolen, borrowed, squandered, doled,
Spurned by the young, but hugged by the old
To the very verge of the church yard mold:
Gold! Gold! Gold! Gold!
Good or bad a thousand fold!
How widely its agencies vary—
To save, to ruin, to curse, to bless,
As even its minted coins express,
Now stamped with the image of good Queen Bess,
And now of a bloody Mary."

Thus wrote Thomas Hood as a moral for his lengthy humorous poem; *Miss Killmansegg and Her Precious Leg.* It is in substance what many poets and prose writers have written about that strange, beautiful, fascinating thing that men call gold.

Many words of power, the names of many of the good and many of the bad rulers of humanity, are spelled with four letters and pronounced in one syllable.

Hate, lust, fame and fear; love, wife, home and hope are among the number, and so, good or bad, is gold.

In some parts of the world cotton is king, in some parts corn is king; in other parts lumber, iron, wheat, or something else. But everywhere gold is this world's god, and nothing can anywhere be king that is not convertible into gold.

But before moralizing on the subject let us look at it in its scientific and other aspects.

GOLD AS A MINERAL. Gold is a metal. It may be called the superlative metal, for in some things it excels all other metals. There are more than seventy simple elements, and more than one thousand mineral species that are produced by the combination of those elements. Gold is one of the simple elements. Its chemical sign is Au, from aurum, Latin for gold. Tourmaline is composed of lime, lithia, fluorine, magnesia, manganese, sodium, calcium, potassa, aluminum, boron, silica, etc. But gold is composed of gold, simply that and nothing more, and yet it is found in combination with silver, iron, copper and other elements. The silver found with gold varies from sixteen hundredths of one per cent to sixteen per cent. Sixteen seems to have a scientific, as well as an economic and political relation to gold.

Gold is rarely found absolutely pure. California gold is about eighty-eight per cent pure. Australian gold is ninety-two and a half per cent pure. The color of gold varies according to its purity, or impurity, from a deep gold yellow to a pale yellow. Since pure gold is too soft for constant wear, it is mixed with an alloy of copper and silver before it is coined or made into jewelry. In twenty-four parts, or carats, gold coin contains twenty-one and nineteen hundredths parts of gold, and two and eighty-one hundredths parts of alloy.

The hardness of gold is from two and one-half to three, about the hardness of common limestone, quartz having a hardness of seven and the diamond of ten, so that gold is comparatively a 'soft thing.' The purest gold is nineteen and a half times as heavy as water. There are two rare minerals that are heavier than gold, iridosmine, which is twenty-one, and platiniridium, which is twenty-three times as heavy as water. A bottle of sand was handed me once, the shining particles in which were supposed to be gold. I poured some of it into water and the shining particles all floated. Comment was unnecessary.

Before the blow pipe gold melts easily. It cannot be dissolved by any simple acid, but is soluble in nitro-muriatic acid.

Gold is highly esteemed largely because it is so unalterable, so unaffected by the corroding forces of nature. It may wear out but it never rusts out. When the tomb of an old Etruscan king was opened the body was found robed and crowned as it had been entombed two thousand years before. When the fresh air touched the remains body and robes crumbled to dust, but the golden fillet that bound his brow remained unchanged. Time cannot destroy this precious metal. Oxygen does not corrode it, as it does iron. Fire may cleanse, but it does not consume it. The gold taken from Egyptian tombs four thousand years old is as fresh and pure as the gold taken yesterday from the mines of Cripple Creek.

Gold is exceedingly ductile. One grain can be drawn out into a wire five hundred feet long. Curiously enough one thousandth part of lead, bismuth, or antimony, mixed with the gold, destroys its power of ductility. Even so it does not take much cold lead to destroy the vitality of the human body. Lead is a deadly poison.

Taken suddenly in round pellets it has killed millions of men. Gold also, though in a different way, has had many victims.

Gold is also very malleable, the most so of any substance. One ounce can be hammered so thin that it will cover one hundred and sixty feet. Thus at an expense of about twenty dollars one could carpet, or ceil, with gold a room sixteen by ten feet. One grain can be made to cover about fifty-seven square inches. When beaten thus thin a green light is seen through the gold. Gold is hammered into leaves so thin that it takes 282,000 to make a thickness of one inch. It has been beaten so thin that it would take 367,500 leaves for an inch. It is then twelve hundred times thinner than ordinary printing paper. It may be said that that is "too thin"; the gold may be, but my statement is not. I can tell a bigger, or thinner, story than that even. A method has been discovered of making gold leaf so thin that one grain will cover five hundred and seventy-six square inches, so thin that 2,998,000 leaves would make a thickness of one inch only, each leaf being 10,584 times as thin as paper. The gold is then trasparent. It ought to be. When as thin as that it is in good condition to take to itself wings and fly away, or to fly away without wings.

Native gold is found in many forms, much of it in fine scales, or grains, called gold dust. It is found in rolled masses of irregular shape called nuggets. These are sometimes very large. In 1887 one was found near Breckenridge, Colorado, that weighed thirteen pounds. In 1865 one was found near Georgetown, California, that weighed seventeen pounds and was worth $4,000. One of eighty pounds, worth $22,700, is said to have been found in California by a man who was digging a grave for his friend. A twenty-eight pound nugget, about the

size of a smoothing iron, was found in North Carolina. In Paraguay pieces weighing from one to fifty pounds were taken from a mass of rock that fell from a high mountain. In a museum at St. Petersburg there is a mass of gold that weighs ninety-six pounds. The Blanch Barkley nugget, found in Australia, weighed one hundred and forty-six pounds. One from Ballarat weighed one hundred eighty-four and one-half pounds, and was worth $41,822. The Welcome nugget was about the shape and size of a leg of mutton, a boulder rather than a nugget. In the shape of a cube it would measure not quite six inches each way. A nugget found at Bandigo in 1869 weighed over one hundred and eighty-nine pounds and sold for $50,000. Byer and Haltman's nugget, found in New South Wales in 1872, weighed six hundred and forty pounds. Its dimensions were four feet nine inches high, three feet three inches wide, with an average thickness of more than four inches. It was found at a depth of two hundred and fifty feet.

Gold is also found in arborescent, or tree-like, form, in spongy masses, and in filiform, or thread-like, shape. Wire gold is simply elongated octahedral crystals.

Gold crystallizes in cubes or octahedrons, in the first, or isometric, system of crystallization. Lead, copper, silver, iron and the diamond crystallize in that way. It is the simplest way. Some of nature's most precious things are very simple.

Gold Considered Geologically. Gold is found in all rocks, from the most ancient to the alluvium now forming in river beds. When found "in place" it is generally in quartz veins in metamorphic rocks, rocks that have been changed from their original form by heat. The gold is scattered through the veins or is found in cavities. These gold-bearing veins are not regarded as

igneous, that is, they are not filled by the injection of melted matter from below. Dana's theory of the formation of gold veins is in substance as follows: The rocks that contain them were once beds of clay, sand or mud, formed by the wear of other rocks and deposited as sediment. By some process in which heat was an important factor those beds were changed, or metamorphosed, into hard crystalline rocks, which were upturned and broken and the fissures and openings filled with quartz veins containing gold. But how were they filled? The quartz and gold were brought into the fissures from the rock on either side by means of the heated waters permeating the rock. Such heated waters, at a temperature very much higher than that of boiling water, have great decomposing power and carry into the cavities whatever they can pick up in the rocks. The gold was scattered through the rock in such minute quantities that it never would have paid to work the rock, but nature with her hot water picked up the little particles and brought them into the veins, from whence it can be profitably extracted.

To get the gold out of the quartz the quartz rock is ground, or stamped, to a fine powder, which is treated with mercury, a mineral for which gold has a special affinity, or liking. The mercury draws out the gold. The gold and mercury produce an amalgam, or mixture, from which the gold is set free by straining and distillation. This method was well known to the ancients. The gold-bearing pyrites of iron and of copper are powdered and roasted to drive off the sulphur. The residue is treated by various complicated processes. New methods for getting gold out of the rock have been devised in modern times, especially for rock that carries but a small per cent of gold.

Much of the gold of commerce however is not found

"in place", but out of place, in river bottoms and gravel beds. Getting gold from such places is called gulch, or placer, mining. How did the gold get there? The forces of nature did what man does when he finds the gold "in place." After nature's hot water had brought the gold into veins and cavities, nature's cold water, expanding in freezing, acted like charges of dynamite to burst the rocks asunder. The oxygen of the air corroded them; the power of gravitation and of running water acted as immense stamp mills, slowly crushing and grinding the rocks to powder, as they were carried down the mountain sides and through the valleys. The finer grains of gold were carried far down the valley. You will find them in the Arkansas and Platte River sands at points far from the mountains. But the larger grains and nuggets soon sank to the bottom, and wherever you get down to bed rock under the creek, or to a cavity in bed rock, or to a place where there was an eddy, there you are liable to find a pocket rich in gold.

In California the gold-bearing gravel-beds, formed by rivers now extinct, are very extensive, being from eighty to two hundred and fifty feet thick. Some of them lie under vast beds of lava that flowed over them.

The method of obtaining the gold from the sand and gravel is very ancient and very simple. Long narrow sluice boxes are placed at the right slope, so that water will run through them rapidly, but not too rapidly. A stream of water is turned in and the gravel is shoveled into the water. At certain places in the box quicksilver is placed, which attracts the heavy gold and holds it fast until the time when, after hours, days or weeks, the owner is ready for "cleaning up," or gathering up the gold that has accumulated.

Sometimes a stream of water is thrown from a pipe

with terrific force upon a gravel bed, tearing it down far more rapidly than many shovels and pick axes could do it. This is called hydraulic mining and has been quite common in California. The streams of water are often thrown with such a force that it would be impossible to stick a crow bar into them, and if one should fairly hit a man it would cut him in two instantly. It is a sort of elongated, continuous cannon ball.

In placer mining water is, of course, the great necessity. Canals of great length are dug to carry the water where it is needed. Pliny speaks of a river whose water was carried in a canal a hundred miles to provide water for gulch mining.

There are various devices and inventions for getting the gold out of the gravel when sufficient water cannot be had. If a successful method has not yet been devised no doubt it will be sometime. There is too much gold awaiting such an invention for inventive skill to fail in that direction.

Gold Considered Geographically. Gold is one of the most common minerals in the world. It is perhaps more common than any other metal except iron, but it is not by any means so abundant as some of the other metals. Gold is found in tens of thousands of places. As it is found in nearly all rocks, so it is found in almost every country on the globe. It is common in Hungary and Transylvania. It is found in the sands of the Rhine, the Rhone, the Ayr and the Danube. The Alps, so rich in scenery, are more or less rich in gold. Gold is found in Spain. Great Britain has it in the streams of Cornwall, in North Wales, in Scotland and in Ireland. Sweden numbers it among her products. It is found in Asia, on the slopes of the Ural mountains for a distance of five hundred miles, and in 1819 that was the most productive region in

the world. Siberia has gold in many places whose names are unspeakable. It is found in China, Japan, Corea, Borneo, the Philippines, and in all those great islands that skirt the continent of Asia. It is found very pure and in large nuggets in Australia. Van Dieman's land and New Zealand are not too far out of the world to have their own gold mines.

Who has not heard and sung of "Afric's sunny fountains that roll down their golden sands"? They rolled them down for Solomon's benefit three thousand years ago, and still they roll, though of late years those fountains have been red, and all the gold of that land stained, with the blood of brave men.

In South America Brazil once produced the larger part of the world's supply of gold. Other South American countries produce it, when they are not engaged in revolutions. So do Central America and Mexico. In North America it is found in countless places in the Rocky Mountains, the Sierra Nevada, the Cascade Mountains and the Coast Range. It is found in British America, and there are millions of it in Alaska. Klondyke has of late years been a name to conjure with among gold seekers. Thousands of men, shut out from communication with the outside world during the winter months, have spent the long arctic night around Cape Nome, latitude 62°, where for many a golden mile the Pacific surf beats on golden sands, the whole beach being rich in gold. The eastern part of our country has gold in great abundance in her vaults, and sparingly in her rocks and valleys. It is found in Virginia, North and South Carolina, Georgia and Pennsylvania. The brick clay under the city of Philadelphia contains gold. It is found in Ohio, Massachusetts, New Hampshire, Vermont and Maine. There have been gold excitements on the prairies

of Nebraska and among the shales of Kansas. Canada has it of course, and so has Nova Scotia. Possibly the future discoverer of the north pole will report rich gold fields there, and start another mining emigration to people that far away region.

Gold is found in the ashes of certain vegetable substances, and it is found in the ocean water, which contains gold at the rate of about one grain, or about four cents worth, in every ton of water. A thousand cubic feet, or a mass ten feet each way, contains about one dollar's worth of gold. If the ocean has an average depth of two miles it contains enough gold to furnish every man, woman and child in the world thirty million dollars, or more than two hundred million to every family of seven. Does it seem a pity that each one of us cannot get our share? But if we all got our shares there would be no one to plough or reap or wash dishes, or do any of the drudgery of life, for everybody, for a time at least, would be a multi-millionaire. The ocean is a rich gold mine and there are plenty of unstaked claims on it and in it. Two practical difficulties, however, hinder the working of those claims, the difficulty of getting the gold out of the water, and the difficulty of storing or dumping the water already worked while the rest is being treated. But no doubt Yankee ingenuity will yet solve those problems. A man who signed himself a Yankee Chemist wrote me a few years ago that he had solved the problem and expected soon to be making ten dollars a day out of the ocean water. I have not heard from him since and I do not think the world has.

Gold Considered Historically. The first mention of gold is in Gen. 2:11, "The land of Havilah, where there is gold." Gold was first used for ornaments.

and the first mention of such use of it is in Gen. 24:22. Abraham's servant gave to Rebekah, in behalf of Isaac, a golden engagement ring and two golden bracelets. It was not until a comparatively late period that gold was coined as money. On old Egyptian tombs gold is represented as weighed in rings for commercial purposes.

In ancient times gold seemed to be very abundant, in some places at least and with some classes. The favored few had more and the masses had less of it than now. For the building of the temple David made a little private contribution out of his own royal pocket of eighty-four million dollars in gold, besides a vast amount of silver, copper and other material. His princes and rich men followed his example and gave, among other things, one hundred and forty million dollars in gold.

Speaking in an oriental way it is said that Solomon, who started out as a bi-metallist, made gold and silver as abundant at Jerusalem as stones. He must have backslidden, however, and became a mono-metallist, for we learn in I. Kings 10:21 that silver was "nothing accounted of in the days of Solomon."

When the queen of Sheba paid Solomon a visit she brought him several nice little presents, and among them were one hundred talents of gold, worth three million three hundred and sixty thousand dollars,—just as a little token of respect. What a dazzling gold-bug she must have been!

Nebuchadnezzar made an image of gold sixty cubits, or nearly one hundred feet, high, and ten feet broad. If it was solid it was the richest and most splendid *imagery* the world ever saw. Probably it was hollow, or else veneered with gold. The multitude then worshipped the image; now they worship the material of which it was

made. All honor to the few who chose then, or choose now, to walk through fiercest flames rather than do either!

The great abundance of gold in ancient times did not materially depreciate its value, because, with barbaric splendor, it was so extensively used for furniture and in kingly display. Solomon's temple was overlaid with pure gold, and so was the altar. Solomon made two hundred targets to shoot at, each one containing six hundred shekels of gold, thus investing more than a million dollars in targets. He also made three hundred shields, each containing three pounds of gold. He made a great throne of ivory and overlaid it with pure gold. The bottom of his chariot was made of gold; so were all his drinking vessels, and all his vessels in his house in the forest of Lebanon. Outwardly it was the golden age of Jewish history. Solomon's yearly income of gold was six hundred and sixty-six talents, or about eighteen million dollars. This was three hundred and sixty times as much as the President of the United States receives, who presides over a country three or four hundred times as large as the one that Solomon ruled over. Our president however has only one wife to support. Solomon had about a thousand. Poor man! He would have been richer in gold and in happiness if he had had but one. A wife is a good thing; Solomon had too many. Gold is a good thing; Solomon had too much of it.

It seems that the ancients understood certain metallurgical processes. Furnaces for gold are mentioned in the Bible. In the 28th chapter of Job there is a curious passage which would answer as a description of gold mining in Colorado today. It has been translated as follows: "Surely there is a source for the silver, and a place for the gold which they refine. Iron is taken out

of the soil, and stone man melts for copper. He hath put an end to darkness and to all perfection: he searcheth the stone of thick darkness and of the shadow of death. He hath made a shaft far from the wanderer: they that are forgotten of the foot are suspended; away from man they wander to and fro. As for the earth, from her cometh forth bread, yet her nethermost parts are upturned as by fire. The place of sapphires are her stones, and dust of gold is his. * * * in the flint man hath thrust his hand; he hath overturned mountains from the root; in the rocks he hath cleft channels, and every rare thing hath his eye seen; the streams hath he bound that they weep not, and that which is hid he bringeth forth to light."

Thus this passage from one of the oldest books in the world plainly describes both lode and gulch mining.

Diodorus Siculus, who wrote from 20 to 50 B. C., tells us that the gold mines of those times were worked by gangs of convicts and captives in fetters, who were kept at their task day and night, guarded by soldiers. An engineer selected the stone and pointed it out to the miners. The harder rock was split by the application of fire, bnt the softer was broken up with pick and chisels. The miners were naked, their bodies being painted the color of the rock they were working. They carried lamps on their heads. The stone was carried out by boys and pounded in stone mortars with iron pestles. The women and old men then ground it in mills to a fine powder. The powder was poured upon a broad, slightly inclined table and water poured upon it to carry away all but the gold. After considerable work the gold was collected and put in an earthen crucible, with a mixture of lead, salt, tin and barley bran. The crucibles were closed with clay and baked in a furnace five days and nights.

The value of gold depends on several things, its superlative qualities, its imperishable character, the amount of it in the world, and the manifold uses made of it. A cubic inch of gold is worth $209.38. A cubic foot is worth $361,728.00. A cubic yard is worth $9,766,656.00. There was once a Colorado politician, now dead, who was reported to be worth ten million dollars. If his wealth had been in solid gold it would have been three feet long, three feet wide and about three feet *high*—or *deep*, according as one looked up to it or down upon it. Some did the former and some the latter. It would have been equivalent to finding two hundred and sixteen of the biggest nuggets ever found. But it all vanished and he died poor.

In ancient Egypt gold was worth thirteen and one-third times as much as silver. In Greece and Rome it was worth only ten times as much, and when Cæsar returned to Rome, only seven and a half times as much. In 1546 the ratio was 10 to 1; in 1849, 15.63 to 1; in 1874, 15 to 1 in 1875 16 to 1; now about 24 to 1.

Gold is more valuable to the world than any other metal except iron, but it is not the most valuable metal by weight. Gold is worth about $300 per pound. There are several rare metals that are, or have been, worth all the way from $1,000 to $10,000 per pound. Radium, the new and wonderful metal that is attracting so much attention among scientists, is worth in the neighborhood of one million dollars a pound, or more than three thousand times its weight in gold. When, by new discoveries or improved processes, these metals become obtainable in larger quantities the prices fall. Aluminum, discovered in 1828, was once as valuable as gold but can now compete with copper.

There is supposed to be in the world, in use or hoarded, seven or eight billion dollars worth of gold, and nearly as much silver, more than half of each amount having been found in America. Enormous quantities of gold are used in the arts, in gilding and especially in electro-gilding. The production of gold is also enormous. From 1848 to 1870 California produced an average of forty-five million annually, or a total of one billion. In 1848 the world's product of gold, omitting Asia, was only thirty million. In 1853 it was one hundred and sixty million. From 1847 to 1873 the United States produced twelve hundred and forty million, or about a million every week. The world has produced the following amounts in the periods named:

1840 to 1850, $364,000,000.
1851 to 1855, $662,000,000.
1856 to 1860, $670,415,000.
1866 to 1870, $448,071,000.
1881 to 1885, $495,582,000.
1886 to 1890, $564,310,000.
1891 to 1895, $815,686,000.

In 1895 the world produced two hundred million, more than in any previous year in the world's history. In 1901 the United States produced over eighty million. In the same year the mineral products of all kinds in our country, including coal and iron, footed up one billion and ninety-two million. Gold is but a small part of the value that comes out of the earth. In ancient times the principal gold producing countries were Arabia, Sheba and Ophir. Where the last two were located is a matter of dispute. Imagine the time, say in 6000 A. D., when scholars shall dispute as to the location of California, and Colorado, of Cripple Creek and Dawson City.

Gold has had much to do with the history of this world. It has been an important factor in politics, commerce, war, religion, and especially in geographical discovery and in the settlement of new countries. An easier way of getting, among other things, the gold of India, was one of the problems that Columbus was trying to solve when, four hundred years ago, he stumbled upon a new world with more gold in it than India ever saw or dreamed of

Many of the early settlers came to this country, not for freedom to worship God, as the Pilgrims did, but to get more of their god, gold. And so little did some of them know about gold as a mineral that from Virginia ship loads of sand filled with shining mica were sent back to England on the supposition that it was gold. It was one variety of fool's gold.

The passion for gold, or the mining passion, it has truly been said, is one of the instruments used by Providence in settling new countries, especially those that are distant and difficult of access. This has been strikingly illustrated in the history of our own land. It brought many settlers to North America and to South America when these continents were first discovered.

It was a little more than a half century ago, when Chicago and St. Louis were small frontier towns, that the cry of "Gold! Gold!" was borne on the western breezes, over lofty mountain ranges, across vast desert plains, and around South America by the ocean route. I can just remember hearing, when I was a small boy, the refrain that was sung through the land:

"Ho boys, Ho!
To California go.
There's plenty of gold,
For so we're told,
On the banks of the Sacramento."

The magic cry had its effect. Multitudes rushed to the new El Dorado. Gold was found, though not by all. But the greatest and best result was that civilization was planted on the Pacific slope, of a rough kind though it was at first, and a wave of material prosperity and conquest was started eastward to meet the corresponding wave, which, under the magic cry of Land! Land! instead of gold, was rolling across the great valley of the Mississippi.

But not for a long time would those two waves have had force to throw more than a few jets of spray over the vast range of mountain ranges, flanked by their death deserts, their alkaline plains and, on this side, by the so-called Great American Desert. And so ten years later, in 1858-59, the cry of gold came to their help. This time it was from what is now called Colorado, from the region whose objective point was Pike's Peak. The California excitement was repeated. Not ocean nor desert, not wild beast nor wilder savage, could keep men away from where gold was, or from where it was said to be.

And what was the result again? Gold was found, and so was silver, and some other things, as health and scenery, health resorts and play grounds for a great nation. But better still civilization, of the Anglo-Saxon kind instead of the Spanish or Mexican kind, was planted on the great Rocky Mountain plateau, as it would not have been, certainly not for a long time, had it not been for the cry of gold.

The Klondike rush is fresh in the minds of all and its end is not yet. Lesser excitements have from time to time borne a surging tide of gold-seekers into new valleys, new regions, new territories. The crest of such tidal mining waves is usually muddy enough, but the clearer sea soon takes its place, while it, the rough, restless, uneasy class of gold-seekers, passes on and passes under.

Of all the strange things connected with the history of gold nothing is stranger than the wild, wierd, long-continued, fascinating, foolish and fruitless search for the philosopher's stone. It shows what a grip gold has upon the affections of this world, the fact that for centuries during and after the middle ages, and down almost to the most modern times, the one great dream and hope of chemists and alchemists, of philosophers, poets and kings, was to find the stone which would turn the baser metals into gold. They had no doubt of there being such a stone if it could only be found. A vast amount of labor, time, thought, midnight oil and money were spent in trying to find that stone, and also the "elixir of life," which was to cure all diseases and make old people young. It was science in its infancy trying to give mankind eternal life. Yet it was this blind groping of science after impossible things that prepared the way for many of the great discoveries of modern times. Astronomy was born of astrology, and chemistry of alchemy.

It was not the ignorant alone, but the learned as well, who believed in the philosopher's stone. The great Francis Bacon believed in it; so did Luther and Spinoza and Leibnitz. When the Baconian philosophy supplanted the Aristotelian the career of modern science began, and the belief in the philosopher's stone gradually passed away.

It was after the beginning of the eighteenth century that Bottgher pretended to have discovered a mineral solvent and to have made gold by means of it. By some trick he made several witnesses believe that he had turned copper into gold. The news spread that the great secret was at last discovered, and crowds flocked to see the wonderful young man, or the "gold-cook," as he was called. When King Frederick I, saw a piece of the gold that had been made out of copper he was so dazzled by the prospect of getting unlimited supplies of gold for his reduced treasury that he resolved to imprison Bottgher, put him in a strong fortress and compel him to make gold. The young man suspected his intentions and fled. A reward was offered for his capture. He appealed to the Elector of Saxony, who was overjoyed at the prospect of getting all the gold he wanted. The Elector sent Bottgher under royal escort to Dresden. Scarcely had he left Wittenberg when a battalion of Prussian soldiers appeared before the gates and demanded the gold-maker's surrender. But it was too late. He was kept under strict guard at Dresden. At the Elector's earnest request Bottgher sent him a small vial with a reddish fluid which, it was said, would turn all metals into gold. This bottle, guarded by a regiment of soldiers, was taken to the Elector. He and his son locked themselves in a chamber, put on leathern aprons, melted copper and applied to it the red fluid. But the copper remained copper. It was proof against conversion. In looking at his instructions the king found that the fluid must be applied "in great purity of heart." That explained his failure, for the king knew that he had spent the evening in very bad company. So he confessed and received absolution, and then tried again, and again he

failed. Then he was furious. He resolved to force Bottgher to reveal the golden secret. Bottgher fled to Austria, was followed, captured, brought back and lodged in a strong fortress. The Elector went to see him. He told him that ten regiments were waiting for their pay and that if he did not make gold at once he would hang him. He was not hung; neither did he make gold. But he made something better. Some one said to him: "If you cannot make gold try to do something else; make porcelain." He took the hint, made countless experiments, and became one of the originators of porcelain ware, or Dresden china. Thus he conferred a far greater benefit on mankind than if he had found the philosopher's stone.

GOLD CONSIDERED MISCELLANEOUSLY, OR IN ITS MORAL AND IMMORAL RELATIONS. The world could not contain so valued an object as gold without its gathering to itself certain mottoes and proverbs. We are told that the vain man's motto is, "Win gold and wear it," a generous man's: "Win gold and share it," a miser's: "Win gold and spare it," a profligate's: "Win gold and spend it," a broker's: "Win gold and lend it," a gambler's: "Win gold and lose it," a wise man's: "Win gold and use it." "All is not gold that glitters," is a truth as old as the use of gold, and it is as useful as gold. It is a golden proverb, and it were well if every young person would accept it early in life as one of the working mottoes of life. No higher tribute can be paid to a person's worth than to say of him that he is "pure gold." Do you suppose, reader, that any one ever said that of you? It is often said of this or that person, more often perhaps of women, "She is worth her weight in gold." Such persons are worth a goodly sum, but not so much perhaps as

one might suppose. If one's wife is worth her weight in gold and weighs one hundred pounds she is worth about thirty thousand dollars. If she weighs two hundred pounds the case is somewhat different. To say that she is worth her weight in big diamonds is equivalent to saying that she is worth untold millions.

Among the qualities of gold not yet mentioned is its wonderful convincing power. Says Addison: "A man who is furnished with arguments from the mint will convince his antagonist much sooner than one who draws them from reason and philosophy. Gold is a wonderful clearer of the understanding; it dissipates every doubt and scruple in an instant; accommodates itself to the meanest capacities; silences the loud and clamorous, and brings over the most obstinate and inflexible. Philip of Macedon by it refuted all the wisdom of Athens, confounded their statesmen, struck their orators dumb, and at length argued them out of their liberties."

Gold, like fire, is a good servant but a hard master. It is good only for its uses, and when it cannot be used then how men sometimes loathe it! When the steamship Central America was sinking there were several hundred miners on board returning from California to their homes and friends. They had made their fortunes and were going home to enjoy them. As death stared them in the face gold suddenly lost its attractions. They took off their treasure belts and threw them aside. Carpet bags full of shining gold dust were emptied on the cabin floor. One man poured out a hundred thousand dollars' worth and permitted any who wanted it to help themselves. What was the market value of gold per ounce then on that ship? Nothing. The more a man had of it the poorer he was. The only woman lost in that disaster

was a stewardess, who selected the heaviest belt of gold from those that had been thrown away and tied it about her body. Tied to the body gold sinks a person quickly into ocean's depths. Tied to the soul it sinks men to perdition's depths. It drowns men in destruction and perdition.

Tarpeia, the daughter of the governor of the fortress on the Capotoline Hill in Rome, was captivated with the golden bracelets of the Sabine soldiers. She promised to let them into the fortress if they would give her what they wore on their left arms. The bargain was made and they kept their promise. As the soldiers entered the fortress they threw their golden bracelets upon the traitoress until she sank beneath their weight and expired. She coveted gold and she got it, but like many another she got more than was good for her. She betrayed the strong fortress and let the enemy in—all for gold. And men still do that. For gold men—some men—will let any enemy into their hearts, their lives, their homes, their country. For gold women will sell their virtue and men their honor; some do, not all, thank God. For gold men will not only leave but abandon home, wife and children. For gold men cross wide oceans, trackless deserts and arctic ice-fields. For gold men will brave any danger and endure any hardship. There are men who for gold will commit any crime.

"For a handful of gold he left us," has been said of more than one great leader who was bribed to betray his party, his country, or his faith.

Says Pollock in his Course of Time:

"Gold many hunted, sweat and bled for gold,
Waked all the night and labored all the day.
And what was this allurement, dost thou ask?

A dust dug from the bowels of the earth,
Which, being cast into the fire, came out
A shining thing that fools admired and called
A god, and in devout and humble plight
Before it kneeled, the greater to the less;
And on its altar sacrificed ease, peace,
Truth, faith, integrity, good conscience, friends,
Love, charity, benevolence, and all
The sweet and tender sympathies of life;
And, to complete the horrid, murderous rite,
And signalize their folly, offered up
Their souls and an eternity of bliss,
To give them—what? An hour of dreaming joy,
A feverish hour that hasted to be done,
And ended in the bitterness of woe."

When we think how madly men seek for gold, and how they worship it, and what crimes they commit for it and with its help, we are almost inclined to surrender our geological theory of the origin of gold, and accept the demonological theory which Sarah Carmichael gives in her poem:

ORIGIN OF GOLD.

"The fallen looked on the world and sneered,
'I can guess,' he muttered, 'why God is feared,
For the eyes of mortals are fain to shun
The midnight heaven that hath no sun.
I will stand on the height of the hills and wait
Where the sun goes out at the western gate,
And reaching up to its crown will tear
From its plumes of glory the brightest there.
With the stolen ray I will light the sod,
And turn the eyes of the world from God'.
He stood on the height when the sun went down;

He tore one plume from the day's bright crown;
The proud beam stooped till he touched its brow
And the print of his fingers is on it now,
And the blush of its anger forevermore
Burns red when it passes the western door.
The broken feather above him whirled,
In flames of torture around him curled,
And he dashed it down on the snowy height
In broken flashes of quivering light.
Ah! more than terrible was the shock
Where the burning splinters struck wave and rock.
The green earth shuddered and shrank and paled,
The wave sprang up and the mountain quailed.
Look on the hills; let the scars they bear
Measure the pain of that hour's despair.
The fallen watched while the whirlwind fanned
The pulsing splinters that ploughed the sand;
Sullen he watched, while the hissing waves
Bore them away to the ocean caves.
Sullen he watched while the shining rills
Throbbed through the hearts of the rocky hills.
Loudly he laughed: 'Is the world not mine?
Proudly the links of its chain shall shine.
Lighted with gems shall its dungeons be,
But the pride of its beauty shall kneel to me'.
That splintered light in the earth grew cold,
And the diction of mortals hath called it GOLD."

The evil one certainly seems to have much to do with the use of gold, as he has with the use of many other good things that God made. But he did not make it. In spite of the poem it remains true that God made the gold. There is a theological theory about its origin, as well as a geological theory, and a demonological one.

It is one of the things that God pronounced "very good," and between the miserly hoarding of gold on the one hand, and the selfish use or stoical disdain of it on the other, there is a golden mean, which is found in the right use of it, in using it and not abusing it, in using it and not being used by it.

Gold is one of the material good things that God made for man, one of the things which, if rightly used, helps on the civilization of the world. I have mentioned some of the evil things done for gold; let us see what some of its good and right uses are. It furnishes a universal standard of value for the commerce of the world, and thus does more than any other one material thing towards making the human race one family. Gold and the Gospel, one material and the other spiritual, are binding our race together, each in its own way. Silver, rightly or wrongly, is demonetized; gold never is. Amid the manifold fluctuations of values in the world commerce would be tied hand and foot, and be paralyzed at times, if it were not for the solid basis that it has in the unchangeable value of gold.

Gold furnishes a material for ornaments and for ornamentation, which everywhere and by everyone from degraded savage to cultured sovereign, is accepted as genuine, beautiful and enduring. Gold never goes out of fashion.

In getting gold out of the earth and separating it from the baser rocks and metals, in coining it into money and working it into ornaments, honest employment is given to multitudes of people.

With plenty of gold at command men are enabled to undertake and carry through vast enterprises in subduing the physical world, building railroads and canals, bridg-

ing chasms and tunnelling mountains, turning barren plains into fruitful gardens and dilapidated towns into queenly cities.

He who has gold, or its equivalent, can with it perform manifold ministries of mercy to his fellow men. He can build asylums, hospitals and libraries; he can endow colleges and plant universities. He can oftimes give health to the sick, strength to the weak, glad joy to weary sufferers, and new hope to the widow and orphan. With it he can get for himself the seven-fold blessings that God promises to those who consider the poor—deliverance in the time of trouble, preservation and life, blessings on the earth, deliverance from enemies, support on the bed of languishing, and a sick bed made by angel hands. (Psalms 40.)

And better still he who has gold can give wings to the best news man ever heard, the glad tidings of great joy, and send it flying to every zone and nation.

This strange thing,—gold! so useful when rightly used, and yet so capable of evil, so indispensable to the world, and yet so useless at times, flying away from us so easily, and yet so heavy that it drags multitudes down to perdition, so bright and enduring, and yet so earthy and stained with so many crimes! By what philosopher's stone can we transmute it so as to make it useful for all time and as enduring as eternity? An awful enemy will it be to meet at the judgment; how can we make to ourselves friends of this mammon of unrighteousness, friends that shall receive us into everlasting habitations when *it* fails? How can we give this heavy metal light wings to bear us heavenward? The answer is very simple—*by doing good with it*, by using it for the glory of Him who made it and us, who made it for us, by so using it as to

send joy to human hearts and the gospel of joy around the world .Such use of it is the true philosopher's stone that transmutes it into heavenly treasure, according to the marvelous laws of the chemistry of the spiritual world.

If one thus uses it, whether he has much or little; yea, if he thus uses the talents of any kind that God has given him, he will have golden memories of the past, and golden hopes for the future; his pathway through life will be a golden pathway. Through gates of pearl he will enter the city that is paved with gold, the very dust of whose streets is—*gold-dust.*

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R. T. CROSS, York, Nebraska

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